SELECTED WATER RESOURCES ABSTRACTS

VOLUME 1, NUMBER 9
SEPTEMBER 1968

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SELECTED
WATER RESOURCES ABSTRACTS

VOLUME 1, NUMBER 9
SEPTEMBER 1968

UNITED STATES DEPARTMENT OF THE INTERIOR
WATER RESOURCES SCIENTIFIC INFORMATION CENTER

TABLE OF TITLES

Page

ADMINISTRATION AND MANAGEMENT

R203032 68A Condemnation of Water Rights 1
R203044X68A R&D Project Control Model Experience 1
R203065 68A Engineers Can Communicate With Managers 2
R203066X68A Floyd Dominy of Burec and the Engineer 2
R203067 68A Human Behavior and Employee Motivation 3
R203085X68A Slowly We Move Toward the Metric 3
R203086X68A Patent Policy 4
R203088X68A Managing Scientific Creativity 4

AGRICULTURE

R203057 68A Cropping Effect on Soil and Irrigation 5
R203071X68A Evapotranspiration from Soil Column 5
R203115 68A Soil Moisture and Food Production 6
R203139X67A Salt Water Agriculture 6
R203231X68A Effect of Grazing on Infiltration 7
R203235 68A Land Use and Chemical Characteristics of Lakes 7
R203240X68A Effects of Pasture Management on Runoff 8
R203278X68A Natural Evaporation and Energy Balance 8

BIOLOGY

R203119X67A Fresh Water Jellyfish--Lake Mead, Nevada 9

CHEMICAL ENGINEERING

R203227 68A Determining Bromine in Brine 9

CIVIL ENGINEERING (GENERAL)

R203051X68A Subsidence Effects on California Aqueduct 10
R203081 68A Tunneling Equipment 10
R203082 68A Stress in Buried Polyester Pipe 11
R203097 68A Shotcrete as Tunnel Support and Lining 11
R203259 67A Derivation of Reservoir Operating Rules 12

DAMS AND HYDRAULIC STRUCTURES

R203052X68A Increased Heights of Modern Dams 12
R203053X68A Measuring Pore Pressure & Seismic Effects 13
R203059 68A Design and Analysis of Arch Dams 13
R203079X68A Flexible Membrane Liners 14
R203084 68A Design of Tunnel Liners 14
R203100 68A Prefabricated Reinforced Concrete Dam 15
R203102 67A Filtration Around Cutoff Collars 15
R203103 67A Slope Protection for Canals & Reservoirs 16
R203150 68A Computation of Pressure Tunnel Linings 16

DEMINERALIZATION

R203158 68A Evaporation from Brines Under Controlled Conditions 17

DRAINAGE AND GROUND WATER

R203015X67A Some Effects of Cyclic Flooding of Soils 17
R203023 67A Statistical Analysis of Ground Water 18
R203025 67A Ground-water Basin Management 18

TABLE OF TITLES - Continued

Page

DRAINAGE AND GROUND WATER - Continued

R203043 68A Interface Upconing in Coastal Aquifers 19
R203072X68A Monitoring Ground Water Quality Changes 19
R203113 67A Properties of Deep Substrata Materials 20
R203116X67A Drainage by Pumped Wells 20
R203122X68A Playa Lake Water Treatment for Recharge 21
R203125 67A Depletion of Stream Flow by Steady Wells 21
R203126X67A Legal Problems in Managing Ground Water 22
R203127 68A Transient Fluid Flow in Multilayered Systems 22
R203129 67A Computer Prediction of Salt in Soil 23
R203132 67A Ground-water Recharge in Israel 23
R203136X67A Transmission Loss of Ephemeral Streambeds 24
R203137 67A Factor Analysis & Ground-water Chemistry 24
R203138X67A Artesian Water in Nigeria's Sokota Basin 25
R203146X68A Digitizing Observation-well Hydrographs 25
R203152 68A Groundwater Levels in North Dakota, 1966 26
R203217 68A Ground-water Data, Polk County, Nebraska 26
R203218 68A Water Levels in Florida Aquifers, 1963-64 27
R203228 68A Groundwater, Paradise Valley, Arizona 27
R203234X68A Solution for Variable Rate Pumping Test 28
R203236 68A Groundwater, Green River Formation, Utah 28
R203243X68A Infiltration into Soils with Hysteresis 29
R203244 68A Neutron Moisture Measurements, Procedures 29
R203246 68A Effects of Sewering on Water Levels 30
R203251X68A Water-table Study Soil Interpretations 30
R203253X68A Flow into a Finite Well 31
R203257 68A Mapping Vertical Variability of Aquifers 31
R203261 68A Statistical Porous Media Hydrodynamics 32
R203263 67A Movement of Particles Through a Sand Bed 32
R203267 67A Cations in Ground Water 33
R203274 68A Water-well Data, Townships 11-25, Alberta 33
R203276 67A Radioactive Elements in an Aquifer 34
R203279 68A Hydrologic Response to Irrigation Pumping 34
R203281 68A Ground Water Resources in Connecticut 35

ELECTRICAL ENGINEERING

R203047X68A BPA's 800-kv D-c Transmission Lines 35
R203054X68A Generator Winding--Preventive Maintenance 36
R203055X68A TVA's RI Experience on 500-kv Lines 36
R203062X68A Nuclear Power Buildup Goes Critical 37
R203087X68A Results of Tests on 400-kv Lines 37
R203104 68A Volgograd-Donbass 800-kv D-c Line 38
R203105 68A Transformer Inrush Current 38
R203106 68A Direct Cooling of Water-wheel Generators 39
R203107 68A Study of Bundled Conductor Oscillation 39
R203108 68A Polyethylene-insulated High-voltage Cable 40

FOUNDATIONS

R203035X68A Pile Foundation Analysis 40

GEOLOGY AND GEOPHYSICS

R203040 68A Review of Tunnel Site Investigations 41
R203078 68A Earthquakes in Western States 41
R203123X67A A Desert Glossary 42
R203142 68A Burro Mountain Ultramafic Body 42

TABLE OF TITLES - Continued

Page

GEOLOGY AND GEOPHYSICS - Continued

R203147 67A Gamma-gamma Logging of Drill Holes 43
R203148 67A Signals Recorded in Deep Seismic Sounding 43
R203233 68A Stresses Causing Land Subsidence 44
R203270 67A Permeability of Curdsville Limestone 44

HYDRAULICS

R203037X68A Water-hammer Control in Pump Systems 45
R203038X68A Flow in Butterfly and Spherical Valves 45
R203039X68A Fall Velocity of Irregular Shaped Grains 46
R203042 68A Transducer Measures Open Channel Flow 46
R203046X68A Hydraulic Design of Large Siphons 47
R203050X68A Tehachapi Pumping Plant Intake Structures 47
R203064 68A Thermal Methods of Flow Measurement 48
R203077 68A Pressure Pulsations in Powerplants 48
R203098X68A Hydraulic Transients in Pumping Plants 49
R203101 68A Turbine Inlet Flow Rate and Pressure Drop 49
R203238X68A Alluvial Channel Resistance to Bed Form 50
R203245X68A Laminar Flow in Rectangular Channels 50
R203260 67A Solutions of the Shallow-water Equation 51
R203275 68A Tainter Gates as Flow Measuring Devices 51

HYDROLOGY

R203013X67A Sediment Settling & Head Loss in Conduits 52
R203014 67A Properties of Stream Channel Sediments 52
R203027 67A Stream Flow Rate Extremes. 53
R203031 67A Stormflow Sources in Small Watersheds 53
R203034 68A Water Projects and Watershed Treatment 54
R203061 68A Runoff in Ungaged Semiarid Areas 54
R203070 68A Tracer Measurement of Streamflow 55
R203089X68A Dye Tracers Collect Hydrologic Data 55
R203090X68A Research Methods in Land-use Hydrology 56
R203117 67A Reservoir Temperature and Evaporation 56
R203131X67A Deposition Behind Low Dams and Barriers 57
R203134 67A Runoff and Hillslope Erosion 57
R203140 68A Runoff Farming: I. Experimental Layout 58
R203153 68A Statistical Properties of Dune Profiles 58
R203155 68A Low-flow Analysis, Bethlehem, New York 59
R203156 68A An Investigation of Floods in Hawaii 59
R203157 68A Hydrogeology, Potowomut-Wickford Area, Rhode Island 60
R203209X67A Sprayed Asphalt Pavements 60
R203211 68A The Meandering of Natural Streams 61
R203213 68A Drought Frequency, Intensity, and Duration. 61
R203214 68A Runoff Coefficients for Small Areas 62
R203216 68A Hydrograph Changes & Watershed Conditions 62
R203223 68A The Effects of Varying Land and Water Use 63
R203226 68A Tank for Demonstrating Alluvial Processes 63
R203232 68A Relation of Channel Width to Permeability 64
R203237X68A Double-mass Analysis on the Computer 64
R203241X68A Sedimentation in Retarding Basins 65
R203242X68A Density Ratio and Sedimentary Similitude. 65
R203247X68A Bankful Frequency in Rivers 66
R203254 68A Coefficients in Sediment Studies 66
R203262 67A Watershed Hydraulics in the Laboratory 67
R203264 68A Ice Dusting at Fairbanks, Alaska 67
R203266 68A Flow Characteristics in an Open Channel 68

TABLE OF TITLES - Continued

Page

HYDROLOGY - Continued

R203269 67A Erosion Effect on Infiltration Rates 68
R203273 68A Time of Travel of Water, Miami River, Ohio 69
R203280 68A Remote Sensing of Hydrologic Dye Tracers 69
R203283 68A Crest-stage Gaging Stations, Oregon 1967 70

IRRIGATION

R203074X68A Head-loss Tables for Sprinkler Laterals 70
R203095X68A Center-pivot Sprinkler Irrigation System 71
R203114 67A Effects of Irrigation on Safflower Yield 71
R203141X67A Advances in Water Harvesting 72

MATERIALS ENGINEERING

R203056X68A Development of Nondestructive Testing 72
R203093X68A Cyclic Condensation Humidity Cabinet. 73

MECHANICAL ENGINEERING

R203048X68A Unprecedented Tehachapi Pump Plant Lift 73
R203049X68A Pump Selection for Tehachapi Pump Plant 74
R203068X68A Valve Engineering for Water Supply. 74
R203099X68A Vibration & Balancing of Flexible Shafts 75

METEOROLOGY AND ATMOSPHERIC WATER RESOURCES

R203058 68A Control of Weather Modification 75
R203121X67A Agrometeorological Aspects of Dew. 76
R203124 67A Synoptic Climatology of the West 76
R203133 68A Variation in Summer Rainfall Distribution 77
R203210 68A Chemical Composition of Precipitation, N C and Va 77
R203224 67A Nuclear Radiation Snow Gage 78
R203239 68A Major Storms in Colorado and Utah 78
R203248 68A Composition of Precipitation, S E Ontario, Canada 79
R203249 67A ESSA Hydrometeorological Publications 79
R203252X68A Rainfall Reduction by Smoke 80
R203277 68A Cesium-144 Rainout Relations 80

PROJECT PLANNING

R203215 68A Marginal Economic Analysis in Recreation Planning 81
R203221 67A Local Water Supply Benefit-cost Analysis 81
R203222 68A Economic Analysis of Flood Storage 82

ROCK MECHANICS

R203045 68A New Considerations on the Vaiont Slide 82
R203080 67A Rock Elasticity in Pressure Tunnel Design 83
R203151X68A Swelling Characteristics of Rock 83

SANITARY ENGINEERING

R203011 66A Tucson Wastewater Reclamation Project 84
R203020 67A Activated Sludge Bacteria Characteristics 84
R203029 67A Behavior of Activated Sludge 85
R203111 68A Dissolved Oxygen Response of a Stream 85
R203112 68A Tracer Studies on Rapid Sand Filtration 86

TABLE OF TITLES - Continued

Page

SANITARY ENGINEERING - Continued

R203149 68A Water Betterment by Ground-water Recharge 86
R203220X67A E. Coli Serotypes Significance in Wastewater Effluent 87
R203225 68A Removal of Phosphate from Digester Liquor 87
R203230X68A Use of Sewage Effluent 88

SOILS ENGINEERING

R203143 68A Engineering Properties of Loess 88
R203144X67A Structures on Swelling Soils. 89
R203145X67A Deformation of Rock-free Soils 89
R203219 68A Pond Sealing by Chemical Treatment. 90
R203255 68A Water-bearing Deposits in Subsiding Areas 90
R203256 67A Static Behavior of Soils. 91
R203258 67A Measuring Soil Moisture with Radio Waves 91

STRUCTURAL AND ARCHITECTURAL ENGINEERING

R203036X68A Optimum Design Using Available Sections 92

WATER-PLANT-SOIL RELATIONS

R203073X68A Pan Evaporation and Evapotranspiration 92
R203094X68A Water Release as a Soil Property 93
R203118X67A Transpirometers to Measure Transpiration. 93
R203120 68A Moisture Use by Fruit Trees 94
R203128X67A Plant Growth Estimated from Climatic Data 94
R203130 68A Water Loss and Stomatal Control in Sorghum 95
R203135X67A Soil Moisture in Greasewood and Sagebrush Stands 95

WATER POLLUTION

R203009 67A Ecology of Farm Ponds in Southwestern USA 96
R203010 67A Selected Papers on Water Pollution 96
R203012 67A Structure of the Diatom Community 97
R203017 66A Urban Storm Water Runoff 97
R203018 68A Aquatic Communities in Water Research 98
R203019 67A Waste Treatment in Paper Manufacturing 98
R203022 67A Industrial Water Pollution Control Policy. 99
R203028 67A Santee Recreation Project 99
R203030 67A Opinion Survey on Water Pollution Control 100
R203041X68A Eutrophication of Water 100
R203069X68A Manmade Contamination Hazards 101
R203075X68A Need for Nutrient Control 101
R203076X68A Aerial Infrared Pollution Surveillance 102
R203083 68A Maximum Acrolein Content for Reservoirs 102
R203091X68A Wastewater Reuse 103
R203092X68A Contaminants from Stabilization Ponds 103
R203109 68A Sulfide to Sulfate Reaction Studies 104
R203110 67A Biology of Fresh-water Environments 104
R203229 68A Portable Water-sample Filtration Unit 105
R203250X68A Temperature and Hardness in Karst Streams 105

WATER RESOURCES

R203016 66A Bibliography, Marine Environment--Oregon 106
R203021X67A Benefit-costs for Local Water Supply. 106
R203024 67A Comparative-projection Models of Reservoirs 107

TABLE OF TITLES - Continued

Page

WATER RESOURCES - Continued

R203026 67A Storing Fresh Water in Saline Aquifers 107
R203033 68A This Environment--Friend or Foe 108
R203060X68A Ecology and Water Resources Development 108
R203063X68A Preservation and River Basin Planning 109
R203096X68A Concept of Water Reuse 109
R203154 68A Water-supply Problems--Southwest Florida 110
R203212 68A Income Redistribution from Reservoir Construction 110
R203265 67A Water Resource in the Farmington Valley 111
R203268 66A Financing State Water Projects 111
R203271 67A Optimization of a Water Resources System 112
R203282 68A Input-output Economic Evaluation of Water 112

MISCELLANEOUS

R203272 68A Lake-oriented Residential Subdivisions 113

R203032 68A CONDEMNATION OF WATER RIGHTS
In view of the evident probability that there will be increasing resort to eminent domain to acquire rights to water supply, American statutes and court decisions, with emphasis upon Texas laws, were collected and analyzed to identify significant problems and make suggestions for their solution. Study was focussed upon the following: (1) the extent to which authority to condemn water rights exists, the laws of Texas being selected for exhaustive analysis for this purpose; (2) the standards for substitution of water uses by eminent domain; (3) the applicability and implications of inverse condemnation; and (4) valuation of water rights and other factors affecting cost of acquisition. General conclusions were: (a) in the state selected, the authority to condemn water rights is unclear in some respects and not as broad as might be desired; (b) legislatures and courts have barely tackled the critical task of stating preferences for substitution of water uses by eminent domain; (c) inverse condemnation of water rights may have harsh consequences, some of which can be minimized; and (d) the cost of acquisition of water rights by eminent domain is substantial, but can be reduced by methods applicable in certain situations. Has 230 references.

R203032 68A

Johnson, Corwin W

CONDEMNATION OF WATER RIGHTS

School of Law Rep, Univ Texas, Apr 1968. 145 p, 230 ref

University of Texas, Austin

DESCRIPTORS--/ cities/ compensation/ ground water/ riparian rights/ laws/ *water rights/ *condemnation/ *eminent domain/ water districts/ preferences (water rights)/ prior appropriation/ Texas/ bibliographies

IDENTIFIERS--/ *appropriative rights/ just compensation/ valuation/ inverse condemnation

R203044X68A R&D PROJECT CONTROL MODEL EXPERIENCE
Traditional research and development (R&D) project cost control systems relate only expenditures with elapsed time, rather than expenditures and achievement with time. Achievement reporting is generally considered separately from cost reporting. A theoretical control model relating cost and achievement with time for R&D projects is developed and described. This model provides: (1) early warnings of impending project failures, (2) more conceptual pinpointing of the forces affecting these impending failures, and (3) detailed analysis of the achievement-per-dollar spent. Controlling by dollars-spent-per-time period potentially yields erroneous conclusions. The results of this study are based on application of the model to chemical development projects and to a representative sample of chemical research projects at the Monsanto Company. The study shows the relationship of these results to the overall development of an integrated planning and control system.

R203044X68A

Souder, William E

EXPERIENCES WITH AN R&D PROJECT CONTROL MODEL

Inst Elec Electron Eng Trans Eng Manage, Vol EM-15, No 1, pp 39-49, Mar 1968. 11 p, 6 fig, 4 tab, 12 ref

Monsanto Co, St Louis, Mo

DESCRIPTORS--/ *research and development/ planning/ administration/ management/ *control/ analysis/ costs/ budgets/ theory/ experimental data/ models/ critical path method/ errors/ operations research/ forecasting/ chemical engineering/ acceptability

IDENTIFIERS-- / comparative studies/ *cost analysis/ management planning/ failures/ evaluation/ expenditures/ cost control

R203065 68A ENGINEERS CAN COMMUNICATE WITH MANAGERS
For an idea to be truly effective, it must be communicated effectively. By improving his communication with management, the engineer can gain recognition, a better feeling of his standing, more interesting assignments, and increased pay and advancement. He can overcome the physical, intellectual, background, and psychological barriers to effective communication by applying 3 basic principles. When applying these principles he should think carefully about his objective and audience and then: (1) Select. The listener will understand and retain most if not more than 3 to 5 major points are presented. Arrange suggested points in decreasing order of contribution to accomplishment of the objective and use only the most significant. (2) Simplify. Adapt the points to the receiver's language and other capabilities, bearing in mind his interests, his attitudes, and his needs. Do not overwhelm him with technical jargon. Most managers are more interested in conclusions and recommendations than in the details of the problem solution. (3) Specify. Use relevant, concrete evidence and examples that the receiver can understand and relate to his own experience. Give him only what he needs to evaluate your message.

R203065 68A

Robinson, Joseph A

HOW ENGINEERS CAN COMMUNICATE MORE EFFECTIVELY WITH MANAGERS

Inst Elec Electron Eng Spectrum, Vol 5, No 6, pp 47-51, June 1968. 5 p

Joseph A Robinson Associates, San Francisco, Calif

DESCRIPTORS--/ *communications/ management/ *engineering personnel/ *scientific personnel/ personnel/ efficiencies/ administration/ applied psychology/ employee relations/ feedback/ preparation/ human behavior/ *employees

IDENTIFIERS--/ ideas/ clarity/ listening/ *conversations/ attention

R203066X68A FLOYD DOMINY OF BUREC AND THE ENGINEER
For 8 yr Floyd Dominy has headed the Bureau of Reclamation, a Federal agency that spends over $300 million annually on construction and operations. He has held this position under several Secretaries of the Interior and constantly changing powerful Congressional committees. As a tribute to him and his accomplishments, he is an affiliate of ASCE although his degree is in agricultural economics. The Bureau has spread its knowledge around the free world as a consultant to foreign governments. Controversy exists because the Bureau is doing this work rather than private U S consultants. Dominy argues that Bureau activities are directed and approved by the President and the Congress and private consultants are not always equipped to do the work. U S architectural and engineering firms often receive foreign contracts resulting from preliminary work performed by the Bureau. A list is given of overseas projects involving the Bureau. One of the more comprehensive foreign activities is visible in the extensive training programs for foreign engineers and technicians. In 17 yr over 7000 foreign specialists have spent a few months to several years as part of the Bureau's Denver engineering force.

R203066X68A

Halmos, E E Jr

FLOYD DOMINY OF BUREC AND THE ENGINEER

Worldwide P&I Plann, Vol 2, No 3, pp 58-64, May-June 1968. 7 p, 1 tab, 1 ref

Worldwide P&I Planning, Washington, D C

DESCRIPTORS--/ *engineering personnel/ *engineering services/ training/ management/ scientific organizations/ governments/ *leadership/ foreign projects/ professional personnel/ responsibilities/ foreign countries/ administration/ *foreign activities/ *foreign engineering service/ preliminary investigations/ consulting engineers/ government employees
IDENTIFIERS--/ *Bureau of Reclamation/ Agency for Intl Dvlpmt/ worldwide/ *foreign aid/ *Dominy, Floyd E

R203067 68A HUMAN BEHAVIOR AND EMPLOYEE MOTIVATION

Some major ideas discovered about motivational processes as they appear in industry are summarized. Six general principles resulting from the study of motivation are: (1) Motivation is psychological, not logical. (2) Motivation is fundamentally an unconscious process. (3) Motivation is an individual matter. (4) Motivating needs differ from person to person and vary from time to time. (5) Motivation inevitably is a social process. (6) The majority of our daily actions is guided by habits established by motivational processes that have been active for many years. A supervisor should look at 7 aspects of each person and consider them together to get the total picture of the individual. These 7 areas are intellectual efficiency, personality, social characteristics, self-insight, insight into others, performance, and character. A supervisor also should understand the psychological needs of an employee and know how to use them as incentives for guidance. Four psychological needs discussed are self-realization, recognition, security, and social experience.

R203067 68A

Miller, Mungo

UNDERSTANDING HUMAN BEHAVIOR AND EMPLOYEE MOTIVATION

Advance Manage J, Vol 33, No 2, pp 47-52, Apr 1968. 6 p

Affiliated Psychological Services, Milwaukee, Wis

DESCRIPTORS--/ *human behavior/ *motivation/ management/ compensation/ supervision/ *personnel management/ employees/ employee relations/ psychology/ applied psychology/ human engineering/ personnel/ incentive awards/ administration/ behavior (psychology)

IDENTIFIERS--/personality/ productivity/ goals/ performance/ ability

R203085X68A SLOWLY WE MOVE TOWARD THE METRIC

Thomas Jefferson proposed to the Congress in 1790 that the U S adopt a decimal system based on metric measurements. A bill was introduced in 1967 to study the possible switchover to the metric system. Eighty-two nations use the metric system; the U S, Canada, Australia, and South Africa are the only major industrial nations clinging to British measurements. Great Britain is converting, with 1975 as the completion date. Japan has completed the conversion with a net gain, after a 6-yr changeover period. Many major U S export companies use dual units of measurement, a duplication that the metric system could eliminate. Positive steps have been taken in converting to the system, despite opposition from industrialists, engineers, and businessmen. Drug manufacturers have changed over and find that economic advantages outweigh difficulties. Leadership for making the changeover must come from engineers and educators. Industry should start an immediate educational and research program to familiarize all engineers and technicians with the advantages of the system, and educational institutions should use the system in instruction. We must act now before we are isolated from the rest of the world.

R203085X68A

Nasser, George D

SLOWLY WE MOVE TOWARD THE METRIC

Consult Eng, Vol 30, No 6, 115-117, June 1968. 3 p

American Concrete Institute Journal, Detroit, Mich

DESCRIPTORS--/ *conversion/ *measurement/ scientific personnel/ weight/ technical societies/ foreign countries/ education/ industries/ costs/ economics/ engineering personnel/ engineering education/ specifications/ scientific organizations/ *standards/ manufacturing/ industrial engineering/ measuring instruments/ management/ mechanical engineering
IDENTIFIERS--/ *metric system/ world trade/ English measurement system

R203086X68A PATENT POLICY
Government patent policy is one of the most troubled issues of the government-industry partnership. Government agencies and departments have a variety of approaches to the control of technology developed through the partnership, resulting in a variety of consequences involving property rights and commercial value. Diversity in patent policy is due principally to the unique internal dynamics and history of the semi-autonomous administrative subsystems involved in the partnership. Patent policies of several governmental agencies are discussed. Has 20 references.

R203086X68A

Lambright, W Henry

GOVERNMENT, INDUSTRY, AND THE RESEARCH PARTNERSHIP: THE CASE OF PATENT POLICY

Public Admin Rev, Vol 28, No 3, pp 214-221, May-June 1968. 8 p, 20 ref

Syracuse University, New York, N Y

DESCRIPTORS--/ *patents/ *policy matters/ industries/ bibliographies/ management/ laws/ *creativity/ *inventions/ research and development/ manufacturing/ liabilities/ compensation/ administration/ technology/ benefits/ economics

IDENTIFIERS--/ *patent law/ ideas/ incentives/ profits/ ownership/ *licenses/ public benefits/ federal government

R203088X68A MANAGING SCIENTIFIC CREATIVITY
The major challenge of the industrial research director is to manage a truly creative short- and long-term effort that meets the test of profitability. The scientist-manager must become involved in a series of personal relationships affecting performance of a group and the creative individuals in the group. After recognizing the creative scientist in the job interview (10 distinguishing characteristics are given), the manager must motivate him to productive creativity without favoritism. Suggestions for guiding a creative employee include: (1) gearing pressures to goals, (2) maintaining two-way communication, (3) appraising his efforts, (4) defending him against attack, (5) giving his subconscious time and opportunity to resolve problems, (6) building his sense of security, (7) tolerating his radical unworkable ideas without harsh judgment, (8) respecting his stimulation sources, (9) providing special direction, (10) providing a creative environment, (11) recognizing creativity, (12) selecting not a totally creative employee but one who can create and also sell his creation, (13) evaluating creative ideas and suggestions quickly, and (14) overlooking harmless foibles that may be critical to creative functioning. Has 18 references.

R203088X68A

Feinberg, M R

FOURTEEN SUGGESTIONS FOR MANAGING SCIENTIFIC CREATIVITY

Res Manage, Vol 11, No 2, pp 83-92, Mar 1968. 10 p, 18 ref

City University of New York, N Y

DESCRIPTORS--/ *creativity/ management/ *motivation/ supervision/ time/ *scientific personnel/ *personnel management/ environment/ research and development/ reasoning/ psychology/ behavior (psychology)/ inventions/ employee relations/ communications/ efficiencies/ standards/ values/ human behavior/ bibliographies
IDENTIFIERS--/ executives/ performance rating/ ideas/ innovation/ goals/ evaluation

R203057 68A CROPPING EFFECT ON SOIL AND IRRIGATION
A study was made to test the hypothesis that cropping treatment affects the water available for plant growth, thereby affecting the need for irrigation during periods without rainfall. Irrigation requirements during the May-August season were investigated relative to some physical properties of Cecil sandy loam as affected by 8 cropping systems ranging from corn grown continuously with stalks removed to grass or alfalfa sod. The cropping systems had no effect on particle size distribution and total porosity, but crust strength decreased and aggregate stability and infiltration rates increased as the quantity of plant material returned to the soil was increased. The increased water intake was offset by increased deep drainage from the root zone, resulting in no change in subsequent irrigation requirements.

R203057 68A

Carreker, John R; Bertrand, Anson R; Elkins, Charles B Jr; et al

EFFECT OF CROPPING SYSTEMS ON SOIL PHYSICAL PROPERTIES AND IRRIGATION REQUIREMENTS

Agron J, Vol 60, No 3, pp 299-302, May-June 1968. 4 p, 3 fig, 5 tab, 10 ref

University of Georgia, Athens; Agricultural Research Service, Baton Rouge, La

DESCRIPTORS--/ *crops/ *soil physical properties/ irrigation O&M/ irrigation/ *water requirements/ agriculture/ infiltration/ percolation/ rainfall/ plant (botany)/ runoff/ soil moisture/ penetrometers

IDENTIFIERS--/ *corn (field)/ sandy loams/ soil-water-plant relations/ plant growth/ root zone/ cropping patterns

R203071X68A EVAPOTRANSPIRATION FROM SOIL COLUMN
Numerical analysis was applied to the steady-state flow equation for evapotranspiration from a vertical soil column. Water uptake by plant roots was incorporated into the flow equation as a negative source term. Evapotranspiration rate and partitioning between plant transpiration and soil evaporation were specified as the top boundary condition; the lower boundary condition was a water table. Results of analysis of a Pachappa sandy loam gave pressure head, water content, source strength, and soil water flux profiles. The study (1) demonstrated that the flow equation with a source term can be solved by numerical means, (2) showed the theoretical influence of parameters in the source term model on flow in soil, (3) indicated qualitatively a water transfer from wet soil through the root system, and (4) indicated that the source term has little effect on the pressure head profile unless the evapotranspiration rate is of the same magnitude as the theoretical limiting value.

R203071X68A

Whisler, F D; Klute, A; Millington, R J

ANALYSIS OF STEADY-STATE EVAPOTRANSPIRATION FROM A SOIL COLUMN

Soil Sci Soc Amer Proc, Vol 32, No 2, pp 167-174, Mar-Apr 1968. 8 p, 13 fig, 12 ref

University of Illinois, Urbana

DESCRIPTORS--/ *evapotranspiration/ numerical method/ *plant (botany)/ soils/ soil science/ *steady flow/ soil moisture/ water table/ analysis/ mathematical analysis/ water pressures

IDENTIFIERS--/ *soil columns/ soil moisture movement/ root zone/ sandy loams/ soil water movement/ root systems/ mathematical models

R203115 68A SOIL MOISTURE AND FOOD PRODUCTION
Some of the benefits which accrue if fuller use is made of available soil moisture have been shown in South Africa. Land benefiting from irrigation comprises only 1 million morgen (a unit of land measurement equal to 2.116 acres) of a 143 million morgen total land area. Therefore, emphasis is placed on utilizing drier lands which comprise 11 million morgen to their full potential. Factors considered are water requirements of plants, control of water used by weeds, moisture distribution in soil and methods to increase moisture content, seedbed preparation methods avoiding unnecessary evaporation and erosion, time of planting and root development. Increased management of the veld is recommended to slow down runoff rate and increase degree of water penetration through fertilization and increased vegetation.

R203115 68A

Hyam, G F S

SOIL MOISTURE AND FOOD PRODUCTION

African J Sci, Vol 64, No 1, pp 13-19, Jan 1968. 7 p, 4 tab, 14 ref

African Explosives and Chemical Industries, Ltd, Northrand, Transvaal

DESCRIPTORS--/ *soil moisture/ weed control/ evaporation/ erosion/ moisture content/ soil management/ dry land farming/ crops/ seeding/ erosion control/ planting management/ arable land/ grasslands/ *dry farming/ food and cover crops/ root zone/ *South Africa

IDENTIFIERS--/ veld

R203139X67A SALT WATER AGRICULTURE
Irrigation with salt water holds some promise of turning sandy soils of many arid lands into productive areas. Principles of salt water irrigation figured in the success of the Desert Garden of Eilat in the Negev Desert in 1949 where some 180 species of non-halophytic plants were grown. Tolerance experiments followed with four types of seawater; Caspian, North Sea, Red Sea or Mediterranean, and an oceanic conentration containing between a 3 and 4% total of dissolved solids. Ten species of plants were used. Four survived oceanic-type irrigation and six survived the Caspian Sea-type. The principles working in such experiments with salt water and sandy soils included the following: Salt did not accumulate in a well-percolated soil thus rinsing through sodium chloride and leaving well-aerated roots. Newer principles included partial root contact, subterranean dew, viscosity principle, and ionic balance between the living system and salt water.

R203139X67A

Boyko, Hugo

SALT-WATER AGRICULTURE

Sci Amer, Vol 216, No 3, pp 89-96, Mar 1967. 7 p, 6 fig

World Academy of Arts and Sciences; Israel Ministry Agriculture, Rehovot

DESCRIPTORS--/ *saline water/ sands/ *sea water/ dissolved solids/ percolation/ *sodium chloride/ aeration/ *ions/ biodegradation/ soil-water-plant relationships/ viscosity/ gravels/ root systems/ brackish water/ *irrigation practices/ deslination processes/ electrolytes

IDENTIFIERS--/ *subterranean dew/ *saline agriculture/ Negev, Israel

R203231X68A EFFECT OF GRAZING ON INFILTRATION, WESTERN COLORADO
Infiltration, runoff, and erosion were measured from test plots on both grazed and ungrazed areas in the Badger Wash area in western Colorado. The area, at an altitude of about 5,000 ft, has sparse desert-type vegetation and shallow soil largely derived from weathered Mancos shale bedrock. During tests made in 1953-54, 1958, and 1963, rainfall at 5-in./hr was applied artificially to each 2.5 sq-ft plot for a 50-min period. The infiltration rate, measured during the last 20 min of the test, was about .15 in./hr greater for grazed than ungrazed areas, but erosion was about 18% higher on grazed areas. Infiltration rate in 1963 was only about 3/4 that for 1958 in both areas although bulk density and penetrometer tests showed the soil was less compacted in 1963. It is suggested that the reduced infiltration might result from less than normal frost shrink-swell in the winter preceding 1963 and in surface compaction from above-normal summer thunderstorms. If the surface soil could be held in optimum condition, perhaps by use of wetting agents or by controlled soil cracking, normal storm rainfall of .25 to .50 in. might be held where it falls. Additional investigations in the Badger Wash area seem to be warranted.

R203231X68A

Thompson, J R

EFFECT OF GRAZING ON INFILTRATION IN A WESTERN WATERSHED

J Soil Water Conserv, Vol 23, No 2, pp 63-65, Mar-Apr 1968. 3 p, 4 fig, 1 tab, 5 ref

Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colo

DESCRIPTORS--/ *infiltration/ water conservation/ *soil moisture/ soil texture/ *erosion/ *soil management/ grazing land/ deserts/ Colorado/ permeability/ percolation/ *watershed management/ infiltrometers/ bulk density/ rainfall-runoff relationships/ compacted soils/ desert plants/ *grazing/ induced infiltration/ soil properties
IDENTIFIERS--/ *infiltration rate

R203235 68A LAND USE AND CHEMICAL CHARACTERISTICS OF LAKES
Conductance values of water from 71 Florida lakes in similar geologic and climatalogic settings showed a log-normal distribution with fair correlation between quality of the water and land-use practices in the lake basins. The specific conductance values ranged from 40 to 550 micromhos. Physical features, such as size of the lake and drainage area and the presence of inlets and outlets, appear to have no determinable effect on the quality of lake water. Water quality variation among the lakes is due primarily to land-use practices. Higher conductivity measured in some lakes is probably due to sulfates which result from application of wettable sulfur to nearby citrus groves. Concentrations of dissolved minerals will increase in a nonleaky closed lake until the water is saline. The presence of fresh water in the lakes in this area indicates that the lakes constantly drain to the groundwater reservoir. Study was made to learn of physical and chemical characteristics of lakes, to correlate certain parameters, and to determine whether the data obtained can be used to define the hydrologic relation between lakes and groundwater.

R203235 68A

Pfischner, F L, Jr

RELATION BEWTEEN LAND USE AND CHEMICAL CHARACTERISTICS OF LAKES IN SOUTHWESTERN ORANGE COUNTY, FLORIDA

Geol Surv Prof Pap 600B, pp B190-B194, 1968. 5 p, 6 fig, 1 ref

Geological Survey, Ocala, Fla

DESCRIPTORS--/ limnology/ chemical analysis/ groundwater recharge/ *land use/ sampling/ *infiltration/ chemical properties/ aquatic environment/ fresh water/ *lakes/ *hydrologic aspects/ conductivity/ citrus fruits/ Florida/ *water chemistry

IDENTIFIERS--/ Orlando, Fla/ leaky aquifers

R203240X68A EFFECTS OF PASTURE MANAGEMENT ON RUNOFF, NEBRASKA
Field experiments during 1939-61 at the Central Great Plains experimental watershed near Hastings, Nebraska, were used to determine the effect of contour furrowing, disking, and grazing management on soil-water storage and forage production. Eight plots were established in 2 pastures having deep silt-loam soil and slopes of about 6%. Furrows were dug with 1-ft vertical spacing on 4 plots, and 1/2 the furrowed and unfurrowed plots were fenced so they could be lightly grazed. After 7 years, more closely spaced furrows were dug on 2 furrowed plots, and 2 of the unfurrowed plots were disked with an eccentric disk. At that time all the plots were seeded with a smooth bromegrass-legume mixture. Furrowing, disking, and light grazing all reduced runoff compared to the untreated heavily grazed plots. Runoff from the contour furrowed plots was only about 20% of that from untreated plots, and was also less than on the disked and lightly grazed plots. The increase in soil water from the various treatment measures did not produce better stands of grass; reseeding and fertilizing were needed to improve grass production. Soil-moisture profiles through the plots suggest that infiltration from the furrows may increase groundwater recharge, but that factor was not evaluated.

R203240X68A

Dragoun, F J and Kuhlman, A R

EFFECTS OF PASTURE MANAGEMENT PRACTICES ON RUNOFF

J Soil Water Conserv, Vol 23, No 2, pp 55-57, Mar/Apr 1968. 3 p, 3 fig, 2 tab, 2 ref

Agricultural Research Service, Hastings, Nebr and Newell, S Dak

DESCRIPTORS--/ *soil moisture/ *water conservation/ *pasture management/ water utilization/ land management/ *runoff/ grazing land/ Great Plains/ *range management/ watershed management/ Nebraska/ induced infiltration/ *grasslands/ water management (applied)/ forage grasses/ contour furrows

IDENTIFIERS--/ forages/ *soil water storage/ grazing/ pastures

R203278X68A NATURAL EVAPORATION AND ENERGY BALANCE
Natural evaporation from agricultural land is evaluated hourly for 29 months near Kristianstad, Sweden. A bulk aerodynamical method is employed with stability dependent coefficient. Key parameters are wind speed at 12 m above ground and temperature and humidity at 1.5 and 12 m. Measurements are representative of areas extending 1 km upwind. Accuracy of values become more significant as averaging time increases. Examples of series of hourly, daily, and monthly values are presented and discussed in terms of influences of different weather elements. Monthly values of potential evaportranspiration are derived with Thornthwaite and Penman formulae. Actual mean evaporation in spring and early summer is one-half that obtained with the Penman formula but almost equal to Thornthwaite values. In late summer and fall Penman values are 1.3 times the actual, but Thornthwaite values are double. Actual evaporation in late fall and winter is greater than formulae values. A seasonal energy balance of the surface shows that nearly equal amounts of net radiation goes to evaporation and to heating the atmosphere in spring and early summer. In late summer progressively more net radiation energy goes to evaporation. In winter large amounts of atmospheric heat accounts for local radiational loss and for evaporation.

R203278X68A

Hogstrom, Ulf

STUDIES OF THE NATURAL EVAPORATION AND ENERGY BALANCE

Tellus, Vol 20, No 1, pp 65-75, 1968. 11 p, 9 fig, 8 ref

University of Uppsala, Sweden

DESCRIPTORS--/ humidity/ temperature/ kinetics/ instrumentation/ *energy balance/ moisture/ *evaporation/ evapotranspiration/ radiation/ water vapor/ *energy budget/ air ciruculation/ vapor pressure/ environmental effects/ *air-earth interfaces/ precipitation (atmospheric)/ wind velocity
IDENTIFIERS--/ *natural evaporation/ *potential evapotranspiration/ Sweden/ Penman method/ Penman equation/ Thornthwaite method

R203119X67A FRESH WATER JELLYFISH--LAKE MEAD, NEVADA
The fresh water jellyfish, Craspedacusta sowerbyi Lankester, appeared in Lake Mead, Nevada in 1962-1963. Observations and collections of medusae were made at approximate 1-week intervals from Oct 25, 1962 to Jan 25, 1963. Divers at selected locations rose from the bottom and counted the jellyfish in an 18-in. hoop at measured vertical distances. It was found the population was concentrated in deeper water in the morning and vertical distribution became more uniform by midday. Surface numbers were low at night and increased rapidly when the sunlight hit the water. This attraction to light was distinct from stimulation to activity by light as shown from laboratory experiments. It was also shown the female population greatly exceeded the male population. Above-average temperature and elevated water level were attributed to the appearance of the jellyfish. When water temperatures fell below 60 deg F a complete absence of males was evident, and the population declines until it disappeared in Jan 1963.

R203119X67A

Deacon, James E and Haskell, W L

OBSERVATIONS ON THE ECOLOGY OF THE FRESHWATER JELLYFISH IN LAKE MEAD, NEVADA

Amer Midland Natur, Vol 78, No 1, pp 155-166, July 1967. 12 p, 3 fig, 4 tab, 13 ref

Desert Research Institute, Las Vegas, Nev

DESCRIPTORS--/ aquatic animals/ *jelly fish/ invertebrates/ water level fluctuations/ water temperature/ distribution patterns/ environmental gradient/ *photoperiodism/ vertical migration/ aquatic life/ *aquatic environment

IDENTIFIERS--/ *Lake Mead

R203227 68A DETERMINING BROMINE IN BRINE WITH X-RAY FLUORESCENCE
The method of determining bromine in brines by using X-ray fluorescence is described and the results are compared with those obtained by the oxidation method. Total bromine is determined directly by measuring the peak-to-background intensity ratio of the bromine K-alpha radiation. In testing the method, 12 synthetic standards were prepared by adding known amounts of bromine to a stock solution of density 1.210 g/ml, 12 additional samples were prepared and adjusted to a density of 1.064 g/ml, and 13 of the samples were analyzed by both the X-ray fluorescence and oxidation methods and the results are compared in a table. The accuracy of the determinations is not affected by the wide differences in the density and composition of the samples. Samples containing 1 to 1000 ppm bromine may be analyzed in about 1 minute with an accuracy comparable to that usually obtained by chemical methods.

R203227 68A

Dunton, Polly J

DETERMINATION OF TOTAL BROMINE IN BRINES BY X-RAY FLUORESCENCE

Appl Spectrosc, Vol 22, No 2, pp 99-100, Mar-Apr 1968. 2 p, 3 tab, 7 ref

Geological Survey, Denver, Colo

DESCRIPTORS--/ water quality/ chemical analysis/ technology/ *brines/ density/ water analysis/ *analytical techniques/ *X-ray fluorescence/ *water chemistry/ elements (chemical)/ mineral water/ halogens

IDENTIFIERS--/ *bromine/ oxidation method/ *dissolved minerals

R203051X68A SUBSIDENCE EFFECTS ON CALIFORNIA AQUEDUCT
Subsidence will affect 200 mi of the 295-mi California Aqueduct located along the foothills of the east slope of the Coast Mountain Range and west side of the San Joaquin Valley. The subsidence is the result of (1) compaction of artesian aquifers (deep subsidence), (2) collapsing of soil structure (shallow subsidence), and (3) consolidation of foundations, and can be separated into 2 general classifications: one affects a large area and continues over a long period of time; the other affects a small area and occurs rapidly. Maps are included showing the location of the California Aqueduct relative to the subsidence areas. Shallow and deep subsidence were considered in the design, in addition to normal consolidation of foundations. The affect of deep subsidence on alinement selection and design for canal freeboard, cracking of canal lining, hydrocompaction, and construction scheduling are discussed.

R203051X68A

Lucas, Clifford V

DESIGN OF THE CALIFORNIA AQUEDUCT FOR EFFECTS OF SUBSIDENCE

Proc, Western Water Power Symp, pp A-1-A-9, Apr 1968. 9 p, 12 fig

California State Department of Water Resources, Sacramento

DESCRIPTORS--/ *aqueducts/ *land subsidence/ geology/ canal embankments/ *canal design/ canal linings/ consolidation/ hydraulic structures/ cost comparisons/ economics/ maintenance/ cracking/ freeboard/ foundations/ design criteria/ canal seepage/ aquifers/ hydraulic gradients/ geomorphology/ engineering geology/ settlement
IDENTIFIERS--/ *California Aqueduct/ California/ *hydrocompaction/ site selection/ *subsidence/ *shallow subsidence/ *deep subsidence

R203081 68A TUNNELING EQUIPMENT
A survey is given of recent developments of machine excavation of underground caverns. Great progress has been made toward fully-mechanized, continuous, and true-to-profile excavation. True-to-profile blasting with minor vibrations has been developed so extensively that the profile line can be maintained dependably and economically. Durability of various tunneling machines opens promising application prospects for rock cavern construction. Rock boring techniques have reached perfection in loosening tools and have made possible mechanical sinking of small-diameter shafts. Shield tunneling machines are available for fully-mechanized excavation of underground caverns and can be used sucessfully in hydraulic operations, in cuttable stable soils and soft rock, and in unstable soils with water penetration. Techniques and equipment used in underground excavation are illustrated. Contains 63 references.

R203081 68A

Linder, Richard

THE FULLY MECHANIZED, CONTINUOUS, TRUE-PROFILE EXCAVATION OF UNDERGROUND CAVERNS

Der Bauingenieur, Vol 42, No 4, pp 124-137, 1967. Transl from Ger, Joint Publ Res Serv Transl 737, June 1968. 47 p, 42 fig, 5 tab, 63 ref

DESCRIPTORS--/ *tunneling/ *tunneling machines/ underground structures/ *tunnel construction/ tunnels/ bibliographies/ excavation/ explosives/ mining/ blasts/ shafts (mining)/ rocks/ foreign construction/ boreholes/ construction/ boring machines/ cutting/ abrasion/ engineering geology/ drills/ drilling equipment/ drilling/ rock excavation
IDENTIFIERS--/ Germany/ smooth wall blasting/ blasting

R203082 68A STRESS IN BURIED POLYESTER PIPE
Stress-strain conditions in subterranean, glass-fiber-reinforced polyester resin pipes were investigated. Experimental procedure and apparatus are discussed. Pipe deformations were measured with telescopic sliding calipers, and circumferential stresses were measured with elongation measuring strips. The investigation indicated that moments calculated using Spangler's theory are too high in pipes of low rigidity such as polyester pipe. Test results showed that: (1) moments at the pipe crown from filler above the pipe are directly dependent on pipe rigidity and change in vertical diameter, (2) deformation and moments in the pipe are reduced by increasing the density of lateral material, (3) vertical load due to the earth above a polyester pipe is less than the load of the earth column above the pipe, (4) moments in the pipe are negligible when laid in sandy gravel, and (5) pipes with partial reinforcement can be used under certain circumstances. Specifying maximum deformations will keep pipe moments to an acceptable value. Danger of denting the pipe wall is the controlling factor for determining wall thickness.

R203082 68A

Carlstrom, Borge and Molin, Jan

STRESS CONDITIONS IN SUBTERRANEAN, GLASS-FIBER-REINFORCED POLYESTER RESIN PIPES

Kunstst, Vol 56, No 12, pp 895-898, 1966. Transl from Ger, Joint Publ Res Serv Transl 748, Jan 1968. 12 p, 12 fig, 3 tab

DESCRIPTORS--/ stress/ *stress analysis/ *pipes/ bending moments/ test procedures/ deformation/ earth pressures/ compressive strength/ ground water/ elasticity modulus/ rigidity/ mathematical analysis/ *plastics/ lateral forces/ soil mechanics/ flexible tubing

IDENTIFIERS--/ *buried pipes/ *polyesters/ foreign research/ *buried tubes/ *glass reinforced plastics

R203097 68A SHOTCRETE AS TUNNEL SUPPORT AND LINING
The first major tunnel in North America using coarse aggregate (plus 1/2 in.) shotcrete for primary support and lining is being completed under an industrial and residential area in Vancouver. The 10,760-ft-long tunnel has a cross section of 29 x 20 ft. Except for 1400 ft in impervious tills, the tunnel passes through a very young series of flat-lying sedimentary beds so unconsolidated that they fall apart on exposure. Specified shotcrete support was 6 in. in the arch and 4 in. in the walls and cost approximately $100 per linear ft. Another $10-$12 per ft was required to finalize the support as a lining. Estimated cost for a conventional steel support system with a concrete lining was $400 per linear ft. Using accelerating admixtures enables shotcrete to set quickly enough to adhere to wet and running water surfaces; 75-80% of the 28-day compressive strengths was reached in 48 hr. Details are given of excavation and lining of the tunnel.

R203097 68A

Mason, E E

THE FUNCTION OF SHOTCRETE IN SUPPORT AND LINING OF THE VANCOUVER RR TUNNEL

Dolmage, Mason and Stewart Ltd Pap, 1968. 18 p, 7 fig

Dolmage, Mason and Stewart Ltd, Vancouver, British Columbia, Canada

DESCRIPTORS--/ *shotcrete/ *tunnel linings/ *tunnels/ rock excavation/ steel linings/ tunnel construction/ admixtures/ compressive strength/ construction/ foreign construction/ setting (materials)/ radial stress/ concrete/ aggregates/ concrete placing/ instrumentation/ supports/ *gunite
IDENTIFIERS--/ *tunnel supports/ Canada/ pressure cells

CIVIL ENGINEERING (GENERAL)

R203259 67A DERIVATION OF RESERVOIR OPERATING RULES
The purpose of this study was to develop a methodology for determining an optimum set of reservoir operating rules specifying monthly allocation of storage space based on the example of Rough River Reservoir, and assuming this multipurpose reservoir provides flood control, water supply, and recreation. Operating rules were derived by the method of marginal analysis using as criteria, achievement of maximum net benefits from available storage capacity. Benefit relationships were derived for each use. Variation of flood control benefits with available flood storage was determined from Corps of Engineers stage-damage curves and statistical analysis of historical storms in the area. Variation of water supply yield within the reservoir was determined by using statistical properties of past streamflow to synthesize month-by-month operation of the reservoir. Recreation benefits were determined for 5 levels of annual visitation (twice the present value) by subdividing use among 3 activity types and estimating how each type would be affected by fluctuation of water level. The 3 benefit curves were combined by the method of marginal analysis, and derived operating rules were expressed as curves which vary with marginal value of an acre-foot of water for water supply. Has 21 references.

R203259 67A

Dowell, Charles O

DERIVATION OF RESERVOIR OPERATING RULES BY ECONOMIC ANALYSIS

Water Resour Inst Res Rep 6, Univ Kentucky, 1967. 116 p, 24 fig, 20 tab, 21 ref

University of Kentucky, Lexington

DESCRIPTORS--/ flood peaks/ *flood routing/ runoff coefficients/ cost-benefit analysis/ *flood control/ bibliographies/ *reservoir operation/ economics/ methodology/ operation and maintenance/ recreation/ storage capacity/ *economic feasibility/ economic efficiency/ reservoir storage/ water management (applied)/ recreation facilities
IDENTIFIERS--/ *Rough River Reservoir, Ky

DAMS AND HYDRAULIC STRUCTURES

R203052X68A INCREASED HEIGHTS OF MODERN DAMS
Changes in the state of the art of design and construction of earth and rock embankments are discussed and the effect of these changes on dam heights considered feasible in recent years. Engineers now are able to design and construct large dams considered beyond their capabilities 20 years ago. The trend toward earth and rock dams of ever increasing height has become readily apparent in this country since the 1940's. Dams 300- to 400-ft high now are quite commonplace, and since 1945 such dams as Round Butte, Mud Mountain, Anderson Ranch, and Union Valley have been constructed in the 400- to 500-ft range; Cougar, Swift, and Trinity in the 500- to 600-ft range; and Oroville in the 700- to 800-ft range. Many influencing factors have made this progress possible. Some of the advances reviewed are: (1) theory, (2) exploration techniques, (3) materials testing, (4) design techniques, (5) specification concepts, (6) materials handling, (7) construction equipment, and (8) instrumentation. Two large California Department of Water Resources dams, Oroville and Castaic, are discussed. Has 15 references.

R203052X68A

Gordon, Bernard B and Wulff, Jack G

THE EFFECTS OF CHANGES IN THE STATE OF THE ART ON HEIGHTS OF EARTH AND ROCK DAMS-OROVILLE AND CASTAIC DAMS

Proc, Western Water and Power Symp, pp A-97-A-110, Apr 1968. 14 p, 4 fig, 2 tab, 15 ref

California State Department of Water Resources, Sacramento

DESCRIPTORS--/ *dam design/ *earth dams/ *dams/ reviews/ rock fills/ embankments/ soil mechanics/ foundations/ foundation investigations/ geologic investigations/ materials testing/ piezometers/ shear/ dam foundations/ seismic design/ instrumentation/ bibliographies/ strain gages/ earth handling equipment/ construction/ *rockfill dams
IDENTIFIERS-- / *Oroville Dam, Calif/ *Castaic Dam, Calif/ *height/ stress meters

R203053X68A MEASURING PORE PRESSURE & SEISMIC EFFECTS
Oroville, Del Valle, and Castaic Dams of the California State Water Project are being instrumented intensively to determine behavior during construction and operation. Instrumentation for measuring pore pressures and seismic effects is discussed. Pore pressure instruments include hydraulic, pneumatic, electric, and porous tube piezometers. Dynamic stress cells, hydrodynamic pore pressure cells, and accelerometers were installed to study behavior of the dams during earthquakes. The instruments, installations, special problems encountered, and some interim results are discussed. Knowledge of embankment behavior revealed by these instruments will define critical areas for more intensive investigation in future dams, and areas where instruments may be placed in lower concentrations. Only electrical seismic monitoring systems can operate successfully, and despite the expense, such systems are justified on large dams in seismically active areas.

R203053X68A

Perry, Charles W and Kruse, George H

INSTRUMENTATION FOR PORE PRESSURES AND SEISMIC EFFECTS--STATE WATER PROJECT DAMS

Proc, Western Water Power Symp, pp A-153-A-174, Apr 1968. 22 p, 16 fig, 13 ref

California State Department of Water Resources, Sacramento

DESCRIPTORS--/ *earth dams/ *embankments/ *pore pressures/ pore water pressures/ soil mechanics/ dam design/ instrumentation/ accelerometers/ porous tube piezometers/ *piezometers/ earthquakes/ *seismic design/ measuring instruments

IDENTIFIERS--/ Oroville Dam, Calif/ Del Valle Dam, Calif/ Castaic Dam, Calif/ dam stability/ *earthquake loads/ *seismic stability

R203059 68A DESIGN AND ANALYSIS OF ARCH DAMS
Twelve papers presented at this symposium show the advances made in the last 10 yr by British universities in developing methods for designing arch dams. The design methods can be applied to much broader fields. Five idealized arch dam profiles were selected for study, ranging from a rectangular profile with a constant radius to a doubly curved arch with a thin crest and a thicker base. The different types of dams are analyzed and compared by mathematical calculations and model studies. Heights of the dams were specified as 30 m for the simplest type of arch and 120 m for the other 4 types. A standard symmetrical valley was selected to guarantee uniform foundation conditions throughout the comparisons. Limited variations in temperature stress conditions were considered. Eleven papers discuss various aspects of design and analysis including: (1) dynamic analysis, (2) use of finite elements, (3) model techniques, and (4) computer methods; the final paper is a critical comparison of results obtained by these methods. Has 112 references.

R203059 68A

Rydzewski, J R; Zienkiewicz, O C; Dungar, R; et al

SYMPOSIUM ON ARCH DAMS--A REVIEW OF BRITISH RESEARCH AND DEVELOPMENT

Symp Arch Dams, Inst Civil Eng, Pap 1-12, Mar 1968. 102 p, 159 fig, 29 tab, 112 ref, 9 append

University of Southampton; University of Wales; University of Bristol, all Great Britain

DESCRIPTORS--/ *arch dams/ *concrete dams/ dams/ *structural analysis/ computer programming/ bibliographies/ *dam design/ model tests/ stress/ shell structures/ dam foundations/ models/ dynamics/ three-dimensional/ mathematical analysis/ seismic design/ static tests/ numerical method/ strain

IDENTIFIERS--/ *finite element method/ foreign research/ dynamic loads/ Great Britain/ design practices/ *dynamic relaxation

R203079X68A FLEXIBLE MEMBRANE LINERS
Asphalt membranes, plastic films, and elastomeric sheets provide effective water barriers as linings in canals and reservoirs. Most linings must be covered for protection against weathering and mechanical damage; however, butyl, ethylene-propylene terpolymer, and a modified polyethylene film are satisfactory for exposed linings. The susceptibility of asphalt membranes to piercing from plant roots and shoots makes use of a soil sterilant on subgrades necessary when asphalt membranes are used. Stream velocity in canals with buried membrane linings should not exceed 3 fps. A gravel topping may be necessary to prevent movement of cover material. Side slopes must be flat enough to prevent the cover from slipping; the maximum slope is 3:1, although a slope of 2-1/2:1 is adequate under some conditions. More restrictive applications govern catchment liners and rain trap storage bags. Butyl rubber is the only membrane tested exhibiting good service.

R203079X68A

Lauritzen, C W

FLEXIBLE MEMBRANES FOR WATER APPLICATIONS

World Irrig, Vol 18, No 3, pp 16-22, Apr 1968. 7 p, 17 fig, 13 ref

Agricultural Research Service, Logan, Utah

DESCRIPTORS--/ *buried membranes/ *linings/ *canal linings/ membranes/ reservoirs/ *flexible linings/ lower cost canal linings/ elastomers/ impervious membranes/ subgrade/ rubber/ polyethylenes/ vinyl plastics/ plastics/ asphalt/ sheeting/ films/ seepage

IDENTIFIERS--/ catchments/ butyl rubber/ *seepage control/ asphalt membranes

R203084 68A DESIGN OF TUNNEL LINERS
This paper presents engineering criteria used in designing concrete liners, steel liners, and stiffener rings for the 7-mi-long, 30-ft-dia Angeles Tunnel, near Gorman, Calif. The tunnel design provides a case study for engineers concerned with designing tunnel liners subjected to internal and external pressures. A tunnel liner (1) provides a nearly watertight envelope that minimizes water losses, (2) prevents rockfalls and protects surrounding rock from erosion, and (3) improves hydraulic efficiency. The analysis employs the cracked rock theory to determine the part of the internal pressure taken by the liner. A steel liner was more economical than reinforcing bars because of the magnitude of internal pressure in this tunnel. Steel liners must be designed to withstand external pressure caused by ground water and internal pressure from tunnel operation. Formulae and charts are given to aid liner design. A brief discussion and summary of theories used in steel liner designs for external pressure are presented. The appendix contains a summary of criteria used in Angeles Tunnel design. Has 21 references.

R203084 68A

Ramos, Nestor G and Abrams, Edward A

DESIGN OF TUNNEL LINERS FOR INTERNAL AND EXTERNAL PRESSURE

Calif State Dep Water Resour Tech Memo No 33, Jan 1968. 41 p, 11 fig, 21 ref, append

California State Department of Water Resources, Sacramento

DESCRIPTORS--/ *tunnels/ *tunnel design/ *tunnel linings/ ground water/ concrete/ stiffening/ water pressures/ steel linings/ design criteria/ elastic theory/ design/ water tunnels (conveyance)/ cracking/ grouting/ stress analysis/ absorption/ economics/ bibliographies/ *pressure tunnels
IDENTIFIERS--/ California/ concrete linings

R203100 68A PREFABRICATED REINFORCED CONCRETE DAM
The hydroengineering complex on the Teterev River, USSR, includes a prefabricated reinforced concrete cellular-buttressed spillway dam with a vacuumless-profile haunch and a bottom tubular floodgate 1 m in dia set relatively high in the left abutment. The spillway is 95.6 m long, 18.2 m wide at the base including buttresses, and 25 m high. The dam foundation is fractured granite grouted with cement to a depth of 10 m. Temporary bottom tubular spillways and cofferdams erected from hollow reinforced concrete blocks were used during construction. The dam has a pressure face and buttresses assembled from hollow reinforced concrete blocks coupled to the monolithic spillway face. Rigidity is achieved by joining the buttresses with reinforced concrete slabs. Hollows in the pressure face blocks and joints in the buttress and pressure face blocks are filled with monolithic concrete, forming a solid waterproof concrete wall. Hollows in the buttress blocks and spaces between the blocks are filled with local soil. The construction technique is an improvement and provides savings in time and costs.

R203100 68A

Lerner, V I and Tsarenkov, A V

PREFABRICATED REINFORCED CONCRETE DAM ON THE TETEREV RIVER

Gidrotekh Stroit, No 6, pp 15-20, 1966. Transl from Russ, Joint Publ Res Serv Transl 757, June 1968. 9 p, 7 fig, 3 ref

DESCRIPTORS--/ *buttress dams/ *prefabrication/ dams/ dam foundations/ cutoff walls/ cutoffs/ *concrete dams/ spillways/ *reinforced concrete/ construction/ cellular structures/ hydraulic structures/ construction costs/ foreign construction/ cofferdams

IDENTIFIERS--/ USSR/ construction equipment/ construction methods

R203102 67A FILTRATION AROUND CUTOFF COLLARS
An earth dam model was studied to determine (1) effect of cutoff collars on filtration, (2) range of influence of cutoff collars, and (3) effect of sharp edges of the collars on ambient soil stability. The study indicated that the effect of the collars on the whole filtration regime is negligible because of the relatively small size of individual cutoff collars compared to the region of filtration and may be disregarded. Theoretically, any sharp edge constitutes a potential hazard to soil stability since infinitely great velocities will occur there even when the vertical angle of the edge tends to 180 deg. These extreme velocities never develop in practice because the theoretical mathematical blade never exists. There is little possibility that velocities will develop enough to move soil particles adhering closely to cutoff collars. Since outlet conduits cannot always be built so that soil adheres closely at each point of the body, cutoff collars causing the smallest increase in seepage velocity should be used. The best collars should have a semicircular cross section, but manufacturing difficulties make this impractical. A triangular cross section with rounded vertices or a rectangular cross section with cut edges is acceptable.

R203102 67A

Smolenska, Dobrostawa

THE PROBLEM OF FILTRATION AROUND SEEPRINGS OF BOTTOM CULVERTS IN EARTH DAMS

Rozpr Hydrotech, No 16, pp 131-146, 1965. Transl from Pol, Tech Transl 67-56055, 1967. 19 p, 13 fig, 4 ref

Polish Academy of Sciences, Gdansk, Poland

DESCRIPTORS--/ *filtration/ *seepage/ seepage losses/ *earth dams/ flow nets/ embankments/ *conduits/ *outlets/ *cutoffs/ models/ model tests/ water pressures/ hydraulic models/ *collars/ *outlet works

IDENTIFIERS--/ foreign research/ Poland/ Darcys Law/ flow patterns

R203103 67A SLOPE PROTECTION FOR CANALS & RESERVOIRS
Six types of concrete and stone linings used to protect slopes of waterways in Poland are discussed. Rockfill placed directly on the slopes and supported by a reinforced-concrete sill and timber anchor piles offers several advantages: (1) the slope can settle without rupturing the lining; (2) ground water can filtrate through the lining; (3) wave energy will dissipate on the rough surface; and (4) repairs can be made easily. A sand-gravel blanket can be placed under the rockfill to protect the slope from the stripping action of waves. Large and small cast-in-place concrete slabs are discussed. Slope subsidence and resultant deformation may cause failures in slabs. Reinforced concrete slabs can be prefabricated into surface configurations that damp wave energy and reduce wave runup. Another type of lining consists of a 0.6-m-thick mattress ballasted with rock and covered with prefabricated concrete elements. Costs of the 6 types of linings are compared.

R203103 67A

Urbanowski, Jan

LINING OF SLOPES OF NAVIGABLE CANALS AND BANKS OF WATER RESERVOIRS

Gospod Wodna, Vol 25, No 10, pp 375-378, 1965. Transl from Pol, Tech Transl 67-56074, 1967. 7 p, 6 fig, 1 tab

District Water Board, Warsaw, Poland

DESCRIPTORS--/ *canal linings/ *slope protection/ *riprap/ embankments/ reservoirs/ wave run-up/ prefabrication/ rock fills/ *wave action/ rock blankets/ reinforced concrete/ foreign design practices/ cast-in-place structures/ linings/ filtration/ cost comparisons/ slabs/ hydraulic structures/ concrete/ concrete structures/ gravel blankets/ canals
IDENTIFIERS--/ Poland

R203150 68A COMPUTATION OF PRESSURE TUNNEL LININGS
A method is proposed for computing reaction coefficient and radial deformation around the cross section of a tunnel lining subjected to internal pressure. Radial deformations are determined from the general solution of a differential equation for the deformation of circular elastic ring; the method does not use arbitrary analytical relationships which do not describe the real character of radial deformations in tunnel linings. Computations show more reliable results are obtained if the coordinate system axes are rotated to a position parallel and normal to rock stratification. If experimentally determined reaction coefficients for different directions are available, the proposed method can be applied not only to orthotropic rocks but also to more complicated cases of anisotropic and nonhomogeneous rocks. Examples of tunnel lining computations are given.

R203150 68A

Eristov, V S

COMPUTATION OF PRESSURE TUNNEL LININGS IN ANISOTROPIC ROCKS

Hydrotech Constr, No 5, pp 436-442, May 1968. 7 p, 7 fig, 4 ref

DESCRIPTORS--/ *pressure tunnels/ *tunnel design/ *tunnel linings/ rock mechanics/ elastic deformation/ stratification/ deformation/ internal forces/ mathematical analysis/ linings/ bending moments/ tensile stress/ foreign design practices

IDENTIFIERS--/ USSR/ *ring displacements

R203158 68A EVAPORATION FROM BRINES UNDER CONTROLLED CONDITIONS

Laboratory studies made under a variety of climatic conditions and with different salt concentrations reveal the complexities and instabilities of salt-fresh water evaporation relationships. The studies support Harbeck's 1955 recommendations for research to supplement his report on procedures for design of lined brine disposal ponds. Earlier studies establish the fact that salts in solution reduce evaporation. However, actual amounts of reduction not known before are determined for several climatic parameters and saline contents. Variables of wind speed, air and water temperatures, and relative humidity are studied in a controlled environmental chamber. It was found that (1) evaporation can be expressed with a physical and a statistical model, (2) under constant water temperature, the effects exhibited by each variable are related to vapor pressure, (3) evaporation ratios vary depending on conditions present, and (4) in the solution profiles, both salt concentration and solution temperature remained essentially constant at all depths for any set of conditions imposed. The variables--air temperature, relative humidity, and salt concentration--give an increase in evaporation when decreased or a decrease in evaporation when increased.

R203158 68A

Moore, Jaroy and Runkles, J R

EVAPORATION FROM BRINE SOLUTIONS UNDER CONTROLLED LABORATORY CONDITIONS

Texas Water Develop Board Rep 77, May 1968. 69 p, 24 fig, 6 tab, 18 ref

Texas Agricultural Experiment Station, College Station

DESCRIPTORS--/ *model studies/ temperature/ *evaporation/ winds/ vapor pressure/ *brine disposal/ humidity/ solutes/ *environmental effects/ variability/ oil fields/ pollutants/ sodium chloride/ fresh water/ salinity/ *brines

IDENTIFIERS--/ *evaporation reservoirs/ *climatic variables/ *salt water disposal/ sized

R203015X67A SOME EFFECTS OF CYCLIC FLOODING OF SOILS

The effects of cyclic flooding and organic matter amendment on water infiltration for ground-water recharge were studied in a soil contained in barrel-type lysimeters. The top 6 in. of soil was amended with cotton gin trash at a rate equivalent to 20 tons per acre. The total volume of water transmitted through the lysimeters was used as a measure of the effectiveness of the cycles investigated. Within 150 days a 7-day flood-7-day dry cycle appeared to be better than either a 10-day flood-4-day dry cycle or continuous flooding. Hydraulic conductivity was determined for the total length of the lysimeter, the 0- to 3-cm, and 3- to 10-cm surface increments. Results of these measurements indicated that a clogging occurred in the 0- to 3-cm increment. Hydraulic conductivity under cyclic flood-dry conditions increased to a maximum value of 75 days and then gradually declined during the remainder of the 150-day study. Under continuous flood conditions, conductivity decreased throughout the experiment. Aggregate stability, pore radii, and hot water-extractable carbohydrate measurements followed the same trends as did the hydraulic conductivity. These changes were associated with the growth and accumulation of microbial tissues. Has 54 references.

R203015X67A

Worcester, Bruce K

THE EFFECT OF CYCLIC FLOODING ON BIOLOGICAL ACTIVITY AND HYDRAULIC CONDUCTIVITY OF A SOIL SURFACE

Department Agr Chem Soils, Univ Ariz, 1967. 127 p, 30 fig, 8 tab, 54 ref, 4 append, disc

University of Arizona, Tucson

DESCRIPTORS--/ *hydraulic conductivity/ *infiltration/ organic compounds/ bibliographies/ *groundwater recharge/ lysimeters/ porosity/ *artificial recharge/ algae/ ground water/ permeability/ soils/ *flooding/ cycles/ conductivity/ water spreading/ pores

IDENTIFIERS--/ *clogging/ *cyclic flooding

R203023 67A STATISTICAL ANALYSIS OF GROUND WATER
A trend-surface analysis of hydrogeologic data was carried out to derive techniques to be used in the selection of areas suitable for the development of future ground-water resources. The investigation was performed in aquifers of glacial origin, one supporting relatively small-scale municipal and industrial ground-water demands, another of large-scale requirements. Trend-surface maps and maps of the residuals from the trend-surfaces were prepared from water level data and evaluated to establish their relationship with the hydrogeologic regimen. The maps were compared with conventional piezometric maps drawn from the same data, and with known subsurface conditions and aquifer parameters. The fluctuations of these maps were compared with variations in recharge and discharge characteristics of the ground-water reservoir. From the results of this study, it was concluded that given suitable water level data, a mathematically computed surface could be considered to approximate the piezometric surface, and that those surfaces would be sensitive to changes in the aquifer parameters. The anomalous areas of the trend-surface or residual maps represent local effects superimposed on the required base and could be explained by a particular set of hydrogeologic conditions.

R203023 67A

Rockaway, J D and Johnson, R B

STATISTICAL ANALYSIS OF GROUND WATER USE AND REPLENISHMENT

Water Resources Res Center Tech Rep 2, Purdue Univ, Lafayette, Ind, Sept 1967. 128 p, 53 fig, 28 ref, 4 append

DESCRIPTORS--/ statistical analysis/ *ground water/ *groundwater recharge/ groundwater geology/ forecasting/ aquifers/ computer programming/ maps/ piezometers/ underground water storage/ hydrogeology/ groundwater basins/ Indiana

IDENTIFIERS--

R203025 67A GROUND WATER BASIN MANAGEMENT
The purpose of this project was to investigate fundamental problems of ground water dynamics and concepts for managing ground water basins. The research was conducted as a series of subprojects, the responsibility for each being assigned to a graduate student. The results have, or soon will be, reported in the form of 15 publications, including 2 articles in the technical journals, 7 research reports and 6 PhD dissertations. Following is a list of the subprojects completed: (1) Mechanics of Turbulent Flow, (2) Lateral Flow in the Unsaturated Zone, (3) Optimization of a Ground Water Basin, (4) Theoretical Analysis of Ground Water Basin Operation Studies, (5) Scheduling of Water Resources Developments in Emerging Nations, and (6) Techniques for Determining Ground Water Flow Fields.

R203025 67A

Todd, David K

SYSTEMS ANALYSIS FOR GROUND WATER BASIN MANAGEMENT

Water Resour Center Tec Completion Rep W105-1A-67, Univ California, Sept 1967. 10 p, 10 ref

University of California, Berkeley

DESCRIPTORS--/ systems analysis/ *ground water/ *groundwater flow/ turbulent flow/ water development/ water resources/ porous media/ optimization/ mathematical models/ *groundwater movement/ *groundwater basins/ water management (applied)

IDENTIFIERS--/ *groundwater management/ developing countries/ groundwater quality/ Navier-Stokes equation

R203043 68A INTERFACE UPCONING IN COASTAL AQUIFERS
For exploitation of fresh ground water in the coastal aquifer of Israel, shallow collector wells are being drilled to intercept fresh ground water flowing toward the sea. Local rise or upconing of the fresh water-saline water interface occurs during pumping. The equations for determining the shape of the rising interface are developed. Because of the nonlinear nature of the boundary conditions, a linearized approximate solution based on the method of small perturbations is described as an analytic solution for cases involving small deviations of the interface. Two- and three-dimensional cases are considered, and the range of validity for the analytical results is verified by experiments in a sandbox model.

R203043 68A

Dagan G and Bear J

SOLVING THE PROBLEM OF LOCAL INTERFACE UPCONING IN A COASTAL AQUIFER BY THE METHOD OF SMALL PERTURBATIONS

J Hydraul Res, Vol 6, No 1, pp 15-44, 1968. 30 p, 11 fig, 11 ref

Israel Institute of Technology, Haifa

DESCRIPTORS--/ *ground water/ *groundwater flow/ *salinity intrusion/ *aquifers/ fresh water/ saline water/ wells/ mathematical analysis/ two-dimensional/ three-dimensional/ hydrology/ movements/ foreign projects

IDENTIFIERS--/ *saline-nonsaline interfaces/ water wells/ Israel/ perturbation

R203072X68A MONITORING GROUND WATER QUALITY CHANGES
Good quality ground water is commonly interspersed with water of inferior quality. Inferior quality water may be naturally occurring salty water commonly underlying fresh water, or it may consist of enclaves of contaminated water from wastes that lie in fresh water bodies. Disposal of wastes on and into the ground and water well pumping cause dispersion of contaminated water. Economic methods are not available for determining boundry zones between contaminated and uncontaminated water. Much reliance is placed on monitoring wells. A prerequisite to monitoring is a synthetic hydrogeologic framework or model showing the behavior of the contaminated water. Such a conceptual model, using pertinent available data, helps assess the need for monitoring and helps guide the monitoring program for optimum results. Unplanned, indiscriminate monitoring of water from wells is expensive, inefficient, and fallible. Monitoring needs will increase in the future, but the proper objective is to improve the technology of determining contaminated water distribution so that monitoring can be minimized and conducted with optimum results.

R203072X68A

LeGrand, Harry E

MONITORING OF CHANGES IN QUALITY OF GROUND WATER

Ground Water, Vol 6, No 3, pp 14-18, May-June 1968. 5 p, 2 fig, 6 ref

Geological Survey, Raleigh, N C

DESCRIPTORS--/ detection/ *ground water/ *water quality/ contamination/ fluctuation/ movements/ measurement/ groundwater flow/ tracers/ *fresh water/ boundaries/ water pollution/ *wells/ subsurface investigations/ waste disposal/ radioactive isotopes/ aquifers/ dispersion/ saline water

IDENTIFIERS--/ variability/ monitoring/ monitors/ cone of depression/ evaluation/ hydrologic models

R203113 67A PROPERTIES OF DEEP SUBSTRATA MATERIALS
The purpose of this investigation was to determine the amounts and kinds of salts and slightly soluble minerals present in the substrata of the west side of the San Joaquin Valley, California. The study was initiated because artificial recharge of excessive surface water is planned in the future and the quality of the percolating water will be influenced by salts present in the substrata. Core samples taken from 19 drilling sites at depths ranging from 50 to 500 ft below ground surface were obtained with a rotary type drill rig. Soluble-salt content, 1:1 extract basis, varied from 0.2 to 10.4 me per 100 gm, between locations and with depth. Salt content was higher in alluvial fans than in the axial trough and virgin or nonirrigated lands also had higher salt contents than irrigated lands. The upper fans contained less soluble sodium percentages than the lower fans and the axial trough. Many sites contained heavy deposits of 20 to 50 me per 100 gm of gypsum. Lime was found in all profiles either in trace amounts or in large accumulations. The substrata material had cation-exchange capacities of plus or minus 25 me/100 gm. Sodium saturation was 4 to 15% of the exchange capacity. High boron concentrations, 5 to 11 ppm in 1:1 extract, were found in certain locations.

R203113 67A

Doneen, L D

I. PROPERTIES OF DEEP SUBSTRATA MATERIALS IN THE WEST SIDE OF THE SAN JOAQUIN VALLEY, CALIFORNIA

Hilgardia, Vol 38, No 9, pp 285-300, June 1967. 22 p, 9 fig, 12 tab, 10 ref, append

University of California, Davis

DESCRIPTORS--/ *salts/ artificial recharge/ percolating water/ lime/ profiles/ boron/ sodium/ gypsum/ alluvium/ physicochemical properties/ solubility/ cation exchange/ *subsoil/ specific retention/ soluble salts/ soil profiles

IDENTIFIERS--/ *San Joaquin Valley, Calif/ axial trough

R203116X67A DRAINAGE BY PUMPED WELLS
Drainage facilities were constructed in the Wellton-Mohawk District in southwestern Arizona to lower ground-water levels and prevent large area areas from going out of production. Drainage was achieved by pumping ground water from 100 wells and moving it out of the area by way of a 73-mi-long concrete lined conveyance channel. In March 1962, when the first Depth to Ground-water map was prepared, almost 26,000 acres of the 60,000 acres of land in the valley had a depth to ground water of 8 ft or less. By March 1964, the area with a 8 ft or less water table had been reduced to 7250 acres. The discharge from drainage wells was salty and caused a salinity problem with Mexico. This was solved when a bypass channel around Morelos Dam, Mexico's principal point of diversion on the Colorado River was placed in operation. Other factors, such as floodflows in the Gila River, have complicated the ground water and salinity control measures. The presence of bacteria in the wells has led to the use of corrosion-resistant materials for construction.

R203116X67A

Moser, Theodore H

DRAINAGE BY PUMPED WELLS IN WELLTON-MOHAWK DISTRICT

Amer Soc Civil Eng, J Irrig Drainage Div, Vol 93, No IR3, pp 199-208, Sept 1967. 10 p, 2 fig, 1 ref

Bureau of Reclamation, Yuma, Ariz

DESCRIPTORS--/ bypass channels/ salinity intrusion/ *drainage wells/ *bypasses/ conveyance structures/ groundwater/ irrigation/ salinity/ *saline water intrusion/ floodwater/ *concrete-lined canals/ pumping/ subsurface mapping

IDENTIFIERS--/ Wellton-Mohawk District/ Mexican Water Treaty 1944/ concrete linings/ Morelos Dam, Mex/ Gila Project, Ariz

R203122X68A PLAYA LAKE WATER TREATMENT FOR RECHARGE
Research was conducted in Bushland, Texas, to evaluate the usefulness of polyelectrolytes as flocculants on typical playa lake water and to design, construct, and test a simple field system using polyelectrolytes to clarify turbid playa lake water. Polyelectrolyte polymers are compounds of high molecular weight which have an electric charge which ionizes in solution. In laboratory tests cationic polyelectrolytes achieved better clarification at lower doses than either anionic or nonionic polymers. Treatment with 0.5 mg per l of cationic polyelectrolyte followed by 5 mg per l of alum reduced suspended solids from 210 mg per l to less than 20 mg per l. The field system removed 90% of the suspended solids from water containg over 200 mg per l of suspended solids at flow rates varying between 500 and 1000 gal per min. Cost for flocculant varied between $6.30 and $9.50 per acre ft. Ninety-four acre ft of muddy playa water was clarified and successfully recharged through wells. Has 15 references.

R203122X68A

Hauser, V L and Lotspeich, F B

TREATMENT OF PLAYA LAKE WATER FOR RECHARGE THROUGH WELLS

Trans Amer Soc Agr Eng, Vol 11, No 1, pp 108-111, 1968. 4 p, 9 fig, 3 tab, 15 ref

U S Department of Agriculture, Bushland, Tex

DESCRIPTORS--/ surface runoff/ floodwater/ aquifers/ *groundwater recharge/ *playas/ colloids/ permeability/ underground storage/ water treatment/ flocculation/ water quality control/ *recharge wells/ sediment control/ turbidity/ bibliographies

IDENTIFIERS--/ polyelectrolytes

R203125 67A DEPLETION OF STREAM FLOW BY STEADY WELLS
The flow of a stream that is hydraulically connected to an aquifer can be reduced considerably by nearby pumping wells. Pumping such wells will either increase the infiltration from nearby streams or decrease the natural groundwater flow that would have discharged into the streams if the wells had not been pumped, or effect both processes at the same time. The depletion of the stream flow is an increase to the perennial yield of the sand. Formulas are available for estimating the amount of induced infiltration from surface-water bodies which have fairly straight channels. Means for such estimates are not available when the wells are located near water bodies that border a quadrant aquifer. Formulas for estimating the rate and volume of stream depletion in right angle stream bends are developed in terms of extensively tabulated functions.

R203125 67A

Hantush, Mahdi S

DEPLETION OF FLOW IN RIGHT ANGLE STREAM BENDS BY STEADY WELLS

Water Resour Res, Vol 3, No 1, pp 227-240, 1967. 6 p, 1 fig, 1 tab, 15 ref

New Mexico Institute of Mining Technology, Socorro

DESCRIPTORS--/ *streamflow/ *wells/ infiltration/ aquifers/ *ground water/ surface-groundwater relationships/ *withdrawal/ pumping

IDENTIFIERS--/ *streamflow depletion

R203126X67A LEGAL PROBLEMS IN MANAGING GROUND WATER
There are 4 legal categories interrelated hydrologically: watercourses, diffuse surface water, underground streams and percolating ground water. Ground water is contained in permeable limestone beds (aquifers). Two main Florida Aquifers are Floridan and Biscayne. Water table and artesian conditions exist. Ground-water problems are interference, overdraft, and contamination. Interference occurs between wells when cones of depression overlap. Overdraft results from pumping at a greater rate than intake from recharge area. Contamination includes pollution of ground water by industrial, municipal or private wastes, and salt water encroachment. These are met by well-cupping stature, multipurpose water management districts, establishment of salt water barrier lines, and pollution control. Ground water is underground streams or percolating and is presumed to be percolating unless shown otherwise. Surface water law covers underground streams. Percolating ground water is governed by 2 rules; under common law, landowner, without malice or waste, may extract unlimited amounts for use on overlying land despite harmful effects to neighbor; and under reasonable use, water may be used for beneficial purposes having reasonable relationship to land. Has 129 references.

R203126X67A

Maloney, Frank E and Plager, Sheldon J

FLORIDA'S GROUND WATER: LEGAL PROBLEMS IN MANAGING A PRECIOUS RESOURCE

Univ Miami Law Rev, Vol 21, No 4, pp 751-776, 1967. 25 p, 6 fig, 129 ref

University of Miami, Miami, Fla

DESCRIPTORS--/ *aquifers/ artesian wells/ *ground water/ *water laws/ water resources/ percolating water/ overdraft/ reasonable use/ legal aspects/ legislation/ Florida/ hydrologic cycle/ underground streams/ surface-groundwater relationships/ saline water intrusion

IDENTIFIERS--/ Floridan aquifer/ Biscayne aquifer/ cone of depression

R203127 68A TRANSIENT FLUID FLOW IN MULTILAYERED SYSTEMS
An analytical solution has been derived which gives the potential distribution in an infinite, 2-layer aquifer with crossflow that is pumped by a partially penetrating well at a constant rate of discharge. Using the finite element method, a new technique based on the minimization of an appropriate variational principle, numerical solutions have been obtained for several complex problems of transient fluid flow in layered systems. Because of the generality of this new approach with respect to arbitrary boundary conditions, a powerful new method of handling problems of fluid flow in complex systems is now available. Cases with both complete and partial penetration in the pumping well have been successfully analyzed. At distances that are less than 2 times the total thickness of a 2-layer system, both the effects of partial penetration and heterogeneity can be significant at early values of time. As time increases, the effects of heterogeneity slowly diminish and the effects of partial penetration dominate. At distances that are greater than 2 times the total thickness of a 2-layer system, the effects of partial penetration are negligible for all values of time and one must consider only the effects of heterogeneity, which slowly diminish with time. Has 74 references.

R203127 68A

Javandel, I and Witherspoon, Paul A

ANALYSIS OF TRANSIENT FLUID FLOW IN MULTI-LAYERED SYSTEMS

Water Resour Center, Univ California Rep 124, Mar 1968. 119 p, 34 fig, 2 tab, 74 ref, disc

University of California, Berkeley

DESCRIPTORS--/ wells/ contours/ unsteady flow/ bibliographies/ fluid flow/ *transients/ *groundwater flow/ *aquifers/ ground water/ porous media/ *stratification/ *groundwater movement/ pump testing/ saturated flow/ aquifer characteristics/ confined water/ analytical techniques/ approximation method/ mathematical models
IDENTIFIERS-- / *transient flow/ *finite element method

R203129 67A COMPUTER PREDICTION OF SALT IN SOIL
A computer method is presented for predicting the equilibrium salt concentration in a soil-soil solution-gypsum system and exchangeable cations at any given soil-moisture content from extract data obtained initially at a different moisture content. The calculations were based on ionic activities, solubility product constant of CaSO sub 4. 2H sub 2 O, dissociation constant of gypsum, and cation exchange equations. The computer program was developed for the IBM 7040 and a source statement along with a diagram to illustrate the flow of computation is included. Tests on five agricultural soils showed good agreement between computed and observed values.

R203129 67A

Tanji, K K; Dutt, G R; Paul, J L; et al

II. A COMPUTER METHOD FOR PREDICTING SALT CONCENTRATIONS IN SOILS AT VARIABLE MOISTURE CONTENTS

Hilgardia, Vol 38, No 9, pp 307-318, June 1967. 12 p, 1 fig, 1 tab, 14 ref

University of California and California State Department Water Resources, Davis

DESCRIPTORS--/ moisture content/ *soil chemical properties/ solubility/ equilibrium/ *salts/ agriculture/ *soils/ computer programs/ cation exchange/ solutes/ gypsum/ *saline soils

IDENTIFIERS--

R203132 67A GROUND-WATER RECHARGE IN ISRAEL
The hydrological aspects of recharge operations on the Coastal Plain Aquifer of Israel from 1959 to the present are reported and the methods, problems, and solutions involved in such an operation are discussed. The allowed withdrawal from the Coastal Plain Aquifer is estimated at about 200 million cubic meters per year. During the last 10 yr 426 million cubic meters per year have been withdrawn causing sea water intrusion to endanger water supply wells in Tel Aviv and Emek Hefer. As a counter measure recharge was practiced in 7 wells at a rate of 6 million cubic meters per year in Emek Hefer, the water coming from adjacent Cretaceous limestone aquifers. In Tel Aviv a fresh water barrier was established in 1964 by injecting lake water into 17 wells during winter at a rate of 6 million cubic meters per winter. Existing pumping wells were used for the recharge operations during the winter. Specific rate of recharge was about 2/3 of the specific capacity during pumping. Recharge by spreading was practiced in Yavneh and Nahan Shikma at rates of 10-13 and 8 million cubic meters per winter, respectively.

R203132 67A

Aberbach, S H and Sellinger, A

REVIEW OF ARTIFICIAL GROUNDWATER RECHARGE IN THE COASTAL PLAIN OF ISRAEL

Bull Int Ass Sci Hydrol, Vol 12, No 1, pp 65-77, Mar 1967. 14 p, 8 fig, 1 tab, 5 ref

TAHAL, Water Planning for Israel, Tel-Aviv

DESCRIPTORS--/ salinity intrusion/ salt water barriers/ *groundwater recharge/ aquifers/ *recharge wells/ drawdown/ water yield/ *saline water intrusion/ hydrology/ groundwater barriers/ saline-nonsaline interfaces/ water spreading/ *artificial recharge/ water levels/ safe yield/ groundwater mining/ pumping
IDENTIFIERS--/ Israel/ fresh water barriers

R203136X67A TRANSMISSION LOSS OF EPHEMERAL STREAMBEDS

A study on streamflow losses and their relation to ground-water conditions on the Walnut Gulch experimental watershed in southern Arizona is presented. Terrace deposits of alluvium from 1200-1600 ft in depth form the major portion of the watershed. About 70% of the total annual precipitation occurs as intense summer convective thunderstorms. Transmission losses are measured as the difference in runoff volume between flumes placed along Walnut Gulch. An example is given of a 1.58 in. rainfall in which there was a 16.5-acre-ft-per-mile loss rate representing an average infiltration rate of 3.5 in. per hr. Ground-water levels rose 18 ft in 1963 with 80 in. of surface infiltration, 60 ft in 1964 with 83 in., and no rise in 1965 with 20 in. of infiltration. A cutoff wall (20 ft in depth) of the flume may have ponded the transmission loss water and created a type of artificial recharge mechanism. It was found by well pump tests that the aquifer transmissibility was 60 gallons per day per foot of aquifer width. Well records for 1963-65 indicate an annual increase of subsurface water beneath the stream bed of Walnut Gulch if sufficient flow events are produced by summer precipitation.

R203136X67A

Wallace, D E and Renard, K G

CONTRIBUTION TO REGIONAL WATER TABLE FROM TRANSMISSION LOSSES OF EPHEMERAL STREAMBEDS

Trans Amer Soc Agr Eng, Vol 10, No 6, pp 786-789, 792, 1967. 5 p, 9 fig

U S Department of Agriculture, Tucson, Ariz

DESCRIPTORS--/ ***surface-groundwater relationships/ *subsurface waters/ thunderstorms/ *storm runoff/ hydraulic conductivity/ alluvium/ water loss/ semiarid climates/ aquifers/ Arizona/ *groundwater recharge/ *streamflow/ *water yield/ *flash floods/ land use/ gravels/ flumes/ rain gages/ hydrographs/ caliche/ sedimentation/ terraces (geological)**
IDENTIFIERS--/ **Walnut Gulch Watershed Ariz/ *transmission losses**

R203137 67A FACTOR ANALYSIS & GROUND-WATER CHEMISTRY

Factor analysis, a method of treatment which takes and rearranges data to present it in a manner that better explains the structure of the underlying system that produced the data, was applied to results of 103 chemical analyses of water samples. These were obtained from wells in the Upper and Middle Mojave River Valley, San Bernadino County, California. Results showed three principal types of water: calcium bicarbonate, sodium sulfate, and sodium chloride and many mixtures of these three. Data were studied to learn the relative importance of each ion in variations of the samples and to examine the possibility of chemical equilibrium between solid and aqueous phases in the aquifers. Critical information on chemical relationships basic to discovery of sources of constituents was furnished by factor analysis.

R203137 67A

Dawdy, D R and Feth, J H

APPLICATIONS OF FACTOR ANALYSIS IN STUDY OF CHEMISTRY OF GROUNDWATER QUALITY, MOJAVE RIVER VALLEY, CALIFORNIA

Water Resour Res, Vol 3, No 2, pp 505-510, 1967. 6 p, 1 fig, 3 tab, 9 ref

Geological Survey, Menlo Park, Calif

DESCRIPTORS--/ ***groundwater/ *statistical methods/ California/ *water quality/ sodium sulfate/ sodium chloride/ correlation analysis/ water chemistry/ regression analysis/ variability/ calcium carbonate/ water analysis/ correlation techniques/ chemical analysis**

IDENTIFIERS--/ **Mojave River, Calif**

R203138X67A ARTESIAN WATER IN NIGERIA'S SOKOTA BASIN
Borehole exploration sponsored by US AID and the Geol Surv of Nigeria, with technical guidance from the USGS, was conducted in the Sokota basin in semi-arid northwestern Nigeria where 2 million people use less than 5 mgd from dug wells and 1 mgd from boreholes. The basin consists of semiconsolidated Cretaceous and Tertiary deposits. This study revealed that the Gwandu Formation contained a productive artesian sand aquifer throughout a 5,700 square mile area with transmissibilities as high as 180,000 imperial gallons a day per foot, decreasing toward the west. The free flow areas totaled about 1000 square miles with pressure heads in boreholes up to plus 83 ft above land surface and individual flows were as great as 12,000 imperial gallons per hour. The quality of water from all pressure aquifers was good, although iron content was high in places and salinity increased in the very deep aquifers. This newly discovered artesian flow will help provide water to remote villages and even supplement irrigation.

R203138X67A

Anderson, H R and Ogilbee, W

EXPLORATION FOR ARTESIAN WATER IN THE SOKOTO BASIN, NIGERIA

Groundwater, Vol 5, No 3, pp 42-46, July 1967. 5 p, 3 fig

Geological Survey, Washington, D C

DESCRIPTORS--/ *artesian wells/ *boreholes/ subsurface investigations/ ground water/ aquifers/ water quality/ drilling/ wells/ *water supplies/ semiarid climates/ confined water/ pressure/ underground storage/ water pressure/ transmissivity

IDENTIFIERS--/ Sokota Basin, Nigeria

R203146X68A DIGITIZING OBSERVATION-WELL HYDROGRAPHS
This article treats not only the digitizing but also the storing and recovery of hydrographs as well as the efficiency of recording, record losses and accuracy. Apparently accuracy increases with an increasing number of records--water level vs time--but efficiency deteriorates while the probability of losing records increases. The hydrologic data considered was from the interior Plains of Canada. Digital recording is advantageous because of the relatively small amount of recording media used for a hydrograph and economy of processing costs. Basic methods of recording are compared, namely fixed time interval vs fixed water level types. The complete set of equations and example data developed would permit the best method of recording and storing digital hydrographs to be established in an area with accuracy being the prime concern in the overall character of a system.

R203146X68A

Gilliland, J A

DIGITIZING, STORING AND RECOVERING OBSERVATION-WELL HYDROGRAPHS

J Hydrol, Vol VI, No 2, pp 142-167, Apr 1968. 25 p, 6 fig, 5 tab, 3 ref

Department of Energy, Mines and Resources, Ontario, Canada

DESCRIPTORS--/ *hydrographs/ *digital recording systems/ ground water/ hydrologic data/ *wells/ water table/ *observation wells/ *recording systems/ time/ records

IDENTIFIERS--/ accuracy/ water level

R203152 68A GROUNDWATER LEVELS IN NORTH DAKOTA, 1966
Measurements of 1966 water levels in 152 observation wells in North Dakota are tabulated. For some wells, water levels for 1963-65 also are reported. Some of the objectives of the water-level program are to provide: (1) long-term records of water-level fluctuations in aquifers, (2) information on changes in groundwater storage, (3) data for base-flow predictions, and (4) data for water-resources research. Water levels in water-table wells fluctuate in response to the effects of recharge (largely from snowmelt and spring rain) and discharge (by evapotranspiration, pumping, and seepage to streams). Artesian aquifers fluctuate primarily in response to pumping and various pressure changes. In addition to water-level records, the report contains county maps showing observation-well locations, hydrographs of representative wells, as well as a list of 24 county groundwater reports and 68 reports for local areas. Has 92 references.

R203152 68A

Randich, P G
GROUND-WATER LEVELS IN NORTH DAKOTA, 1966

N Dak State Water Comm Ground-Water Study 74, 1968. 117 p, 33 fig, 92 ref

Geological Survey, Bismarck, N Dak

DESCRIPTORS--/ *observation wells/ North Dakota/ *groundwater/ *water levels/ hydrologic data/ *water level fluctuations/ subsurface waters/ aquifers/ hydrogeology/ water table/ confined water/ water wells/ data collections/ underground storage/ seepage/ geohydrologic units

IDENTIFIERS--/ *well data/ *data networks/ groundwater sources

R203217 68A GROUND-WATER DATA, POLK COUNTY, NEBRASKA
Ground-water basic data is presented for Polk County, in the Big Blue River basin of east-central Nebraska. The data include a descriptive sample log of an observation well drilled in 1959, descriptive data for 782 irrigation and 24 municipal wells, periodic water-level measurements in 53 wells, and chemical analyses of water from 9 wells. Logs of 29 test holes drilled in 1942-49 were given in an earlier report; an interpretive report of the ground-water resources is being prepared. About 71,000 acres were being irrigated with ground-water in 1965.

R203217 68A

Smith, F A and Weakly, E C

GROUND-WATER DATA, POLK COUNTY, NEBRASKA

Nebr Water Surv Pap 22, Univ Nebr, May 1968. 40 p, 4 fig, 4 tab, 4 ref

University of Nebraska, Lincoln

DESCRIPTORS--/ *hydrologic data/ *water quality/ water sources/ water table/ aquifers/ observation wells/ chemical analysis/ water analysis/ *water wells/ *groundwater/ Nebraska/ data collections/ water level fluctuations/ water levels/ *irrigation wells

IDENTIFIERS--/ *municipal wells/ well data

R203218 68A WATER LEVELS IN FLORIDA AQUIFERS, 1963-64

Trends and water-level fluctuations are summarized for the principal water-table and confined aquifers in Florida. The principal aquifers in the state are the Biscayne aquifer in the southeastern part, the Floridan aquifer in the central and northern part, and the sand and gravel aquifer in the extreme northwestern part. Graphs of pumpage for each of the major cities for periods of 20 to 40 yr show a substantial increase in pumping in all areas since 1940. Water-level hydrographs of wells in all parts of the state illustrate water-level changes and trends. In several heavily pumped areas, water levels have declined several ft since 1947. Small maps show the piezometric surface of the Floridan aquifer and area of artesian flow, locations of observation wells, and changes in water levels in heavily pumped areas. Water-level data are obtained from a network of about 1,000 observation wells in all parts of the state. Well and water-level data for 329 of these wells are tabulated. The table includes the highest and lowest water levels measured prior to 1963, highest May or June water levels in 1963 and 1964, and the annual range of fluctuation for 1963 and 1964.

R203218 68A

Healy, Henry G

WATER LEVELS IN ARTESIAN AND NONARTESIAN AQUIFERS OF FLORIDA, 1963-64

Florida Div Geol Inform Circ 52, 1968. 68 p, 46 fig, 1 tab

Geological Survey and Florida Division of Geology, Tallahassee

DESCRIPTORS--/ water table/ aquifers/ *hydrographs/ artesian wells/ *observation wells/ water utilization/ saline water/ fluctuation/ water wells/ *water levels/ *water level fluctuations/ *groundwater/ Florida/ confined water/ pumping/ withdrawal/ piezometry/ potentiometric level/ *hydrogeology/ subsurface waters
IDENTIFIERS--/ artesian aquifers/ groundwater hydrology/ *groundwater hydrographs

R203228 68A GROUNDWATER, PARADISE VALLEY, MARICOPA COUNTY, ARIZ

A description and an analysis of groundwater conditions in Paradise Valley, Arizona, are presented. The area is underlain by more than 1,500 ft of water-yielding alluvial deposits--divided into lower, middle, and upper units--which in places overlie the red unit of conglomerate and siltstone. Although the alluvial deposits and red unit combine hydrologically to form an aquifer system, each unit differs in water-yielding capacity. Yield-drawdown data for wells in southern Paradise Valley indicate that the upper and lower alluvium and red unit are more permeable and yield more water to wells than the middle alluvium. In central and northern parts of the valley, wells are less productive, the upper alluvium being dry in much of the area. Although hard, the groundwater is suitable for municipal, irrigation, and farm uses. In the southern part of the valley, however, water from some wells contains more than recommended amounts of dissolved solids for domestic use. Annual withdrawal increased from 44,000 acre-ft in 1946 to 80,000 acre-ft in 1964. Public supply usage in 1965 was 4 times that of 1945: this reflects conversion of agricultural land to an expanding metropolitan area. Has 16 references.

R203228 68A

Arteaga, F E; White, Natalie D; Cooley, M E; et al

GROUND WATER IN PARADISE VALLEY, MARICOPA COUNTY, ARIZONA

Arizona State Land Dep Water Resour Rep 35, May 1968. 76 p, 15 fig, 5 tab, 16 ref, append

Geological Survey, Phoenix, Ariz

DESCRIPTORS--/ canal seepage/ water table/ artesian wells/ *chemical properties/ water utilization/ *permeability/ *aquifer characteristics/ geologic control/ alluvium/ Arizona/ conglomerate rocks/ recharge/ specific capacity/ hardness (water)/ groundwater movement/ groundwater basins/ water management (applied)/ *groundwater/ bibliographies
IDENTIFIERS--/ yield-drawdown relationships/ Paradise Valley, Ariz/ drawdown curves/ *groundwater system

R203234X68A SIMPLIFIED SOLUTION FOR VARIABLE RATE PUMPING TEST
A simplified graphical solution is developed for determining coefficients of transmissivity and storage from a variable discharge pumping test. The method is based on Jacob's formula and a graphical plot that gives transmissivity equals 1/4 (pi)(m), where (m) is the slope of the plotted line. The solution is valid for values of u less than 0.01.

R203234X68A

Sternberg, Yaron M

SIMPLIFIED SOLUTION FOR VARIABLE RATE PUMPING TEST

Proc Amer Soc Civ Eng, J Hydraul Div, Vol 94, No HY1, pp 177-180, Jan 1968. 4 p, 1 fig, 1 tab, 4 ref, append

Indiana University, Bloomington

DESCRIPTORS--/ hydraulics/ *ground water/ permeability/ aquifers/ *wells/ graphical analysis/ *transmissivity/ aquifer characteristics/ *analytical techniques/ *storage coefficient/ hydrologic properties/ subsurface waters/ *pumping

IDENTIFIERS--/ *aquifer tests

R203236 68A GROUNDWATER, GREEN RIVER FORMATION, UINTA BASIN, UTAH
Relatively fresh groundwater occurs in moderately large quantities in parts of the outcrop of the Eocene Green River Formation, Uinta Basin, Utah, which also contains large reserves of bituminous sand and oil shale. Whether the hydrocarbons can be developed economically depends in large measure on available process water of suitable chemical quality. Sufficient water may be locally at hand in aquifers that now furnish many wells and springs. Analyses of water from 51 wells and a spring indicate that 4 sources were fresh (less than 1,000 ppm dissolved solids), 18 were slightly saline (1,000 to 3,000 ppm), and the remainder were moderately saline to briny. Average annual precipitation in most of the basin is less than 12 in., but 20 to 30 in. falls on the high areas of the basin's south and west sides. Because development of the large hydrocarbon reserves can be economically more feasible if sources of suitable water are available, detailed hydrologic appraisals of occurrence, distribution, quantity, and quality of the groundwater are needed.

R203236 68A

Feltis, R D

PRELIMINARY ASSESSMENT OF GROUND WATER IN THE GREEN RIVER FORMATION, UINTA BASIN, UTAH

Geol Surv Prof Pap 600-B, pp B200-B204, 1968. 5 p, 1 fig, 1 tab, 2 ref

Geological Survey, Billings, Mont

DESCRIPTORS--/ *chemical analysis/ wells/ hydrologic data/ fresh water/ water analysis/ mining/ saline water/ *ground water/ *aquifers/ Utah/ *water supply/ mineral industry/ *oil shale/ aquifer characteristics/ springs/ precipitation (atmospheric)

IDENTIFIERS--/ Green River Formation/ Uinta Basin, Utah/ *aquifer potential

R203243X68A INFILTRATION INTO SOILS WITH HYSTERESIS

Drainage and inflitration in partially saturated soils exhibit hysteresis because of the negative water pressure which results from previous wetting and drying. Numerical methods are used to solve the differential equation describing vertical flow in such soils. By using a digital computer, solutions are obtained for different initial and boundary conditions. These solutions representing alternating infiltration and drainage cycles in the absence of evaporation in a uniform soil of infinite depth with a uniform moisture content. The hysteresis in the moisture-suction relationship was taken into account by means of the concept of independent domain and the use of limiting assumptions. Graphs of moisture-distribution profiles and effective saturation against time show that the main force acting during infiltration is capillarity rather than gravity. Has 17 references.

R203243X68A

Ibrahim, Hassen Ali and Brutsaert, Wilfried

INTERMITTENT INFILTRATION INTO SOILS WITH HYSTERESIS

Proc Amer Soc Civ Eng, J Hydraul Div, Vol 94, No HY1, pp 113-137, Jan 1968. 25 p, 19 fig, 2 tab, 17 ref

Cornell University, Ithaca, N Y

DESCRIPTORS--/ hydraulics/ *drainage/ *infiltration/ *hysteresis/ soil water/ moisture content/ bibliographies/ *soil water movement/ drainage effects/ mathematical models/ capillary action/ capillary conductivity/ negative pore pressure

IDENTIFIERS--/ infiltration rate/ infiltration cycles/ infiltration capacity

R203244 68A NEUTRON MOISTURE MEASUREMENTS PROCEDURES

A recently developed neutron meter records moisture measurements by continuous and point-logging procedures. An important application is the measurement, in drill holes, of moisture changes with time in the unsaturated zone. Field calibration of the meter shows a linear relationship between instrument reading and moisture content over a range of 5 to 40% moisture by volume. Comparison of neutron mositure logs obtained by different logging procedures illustrates that a compromise must be made between logging time, bed definition, and curve reproducibility. Tests indicate that point-logging, using close logging intervals, provides the more accurate results. Continuous-logging, which requires much less time and manual operation, can provide acceptable logs for many moisture studies. Good zone definition and moisture-change accuracy are obtainable in continuous logging at a speed of 0.8 ft per min and time constant of 20 sec. Graphs showing results of both logging procedures are given.

R203244 68A

Prill, Robert C and Meyer, Walter R

NEUTRON MOSITURE MEASUREMENTS BY CONTINUOUS- AND POINT-LOGGING PROCEDURES

Geol Surv Prof Pap 600-B, pp B226-B230, 1968. 5 p, 4 fig, 3 ref

Geological Survey, Garden City, Kans

DESCRIPTORS--/ instrumentation/ calibrations/ sediments/ drill holes/ moisture content/ stratification/ drainage/ ground water/ gravitational water/ *nuclear moisture meters/ *borehole geophysics/ hydrologic properties

IDENTIFIERS--/ *neutron moisture probes

R203246 68A EFFECTS OF SEWERING ON WATER LEVELS, LONG ISLAND, N.Y.
Double-mass-curve analysis of groundwater levels in Nassau County, Long Island, shows that water levels in a 50-sq mi area sewered in the early 1950's have declined an average of 10 ft relative to an unsewered area nearby. Analysis of factors causing this relative decline indicates that about 7 ft was caused by sewering and the remainder, by pumping in Queens County, urbanization, and the 1961-66 drought. At specific locations, water-level decline from sewering ranged from 1 to 15 ft. Assuming a specific yield of 20% for the shallow aquifer, the estimated average loss of groundwater from storage as a result of sewering is about 3 mgd since 1953. The decline in groundwater levels has been accompanied by pronounced reductions in streamflow, corresponding to an average of about 3.3 cfs (2 mgd) since 1953. Streamflow losses averaged about 5.7 cfs for the period 1958-66 in the 2 gaged streams within the sewered area.

R203246 68A

Franke, O L

DOUBLE-MASS-CURVE ANALYSIS OF THE EFFECTS OF SEWERING ON GROUND-WATER LEVELS ON LONG ISLAND, NEW YORK

Geol Surv Prof Pap 600-B, pp B205-B209, 1968. 5 p, 2 fig, 2 tab, 2 ref

Geological Survey, Mineola, N Y

DESCRIPTORS--/ *sewers/ aquifers/ streamflow/ groundwater recharge/ runoff/ droughts/ drainage/ waste disposal/ sewage effluents/ *ground water/ *surface-groundwater relationships/ *water level fluctuation/ New York/ urbanization/ mass curves/ groundwater movement/ pumping/ drainage water/ gaging stations/ *subsurface drainage
IDENTIFIERS--/ Long Island, N Y

R203251X68A WATER-TABLE STUDY VERIFIES SOIL INTERPRETATIONS
Soil-drainage characteristics, interpreted from published soils maps, were verified by water-table measurements made in observation wells at 35 sites in Montgomery County, Pennsylvania. Poorly drained soils generally are light gray in color and remain wet a large part of the time. The water table beneath such soils was less than 1.5 ft below the surface during 8 months of a 1 yr study. The well-drained soils are brownish, yellowish, or reddish, and drain rapidly enough to prevent soil saturation for a significant period of time. Most of the time the water table beneath these soils was at depths of 3 ft or more. The records of water levels in the observation wells substantiated the interpretations of drainage capabilities for the 4 soil classes. The moderately-drained to poorly-drained soils have severe limitations for on-site disposal of sewage through septic tanks. Wet basements and contamination of drinking water are other problems associated with the poor soil drainage.

R203251X68A

Latshaw, Gerald J and Thompson, Robert F

WATER TABLE STUDY VERIFIES SOIL INTERPRETATIONS

J Soil Water Conserv, Vol 23, No 2, pp 65-67, Mar-Apr 1968. 3 p, 1 fig, 2 tab, 2 ref

Soil Conservation Service, Harrisburg and Norristown, Pa

DESCRIPTORS--/ *soil classifications/ *water table/ *drainage/ drainage effects/ observation wells/ septic tanks/ soil engineering/ soil types/ *soil water/ *water level fluctuations/ *subsurface drainage/ drainage engineering/ subsurface waters/ Pennsylvania/ *groundwater

IDENTIFIERS--/ soil characteristics

R203253X68A MATHEMATICAL SOLUTION FOR FLOW INTO A FINITE WELL
The problem of determining the drawdown in response to flow from a finite radius well fully penetrating an infinite confined aquifer, where the rate of flow from the well is an arbitrary function of time, is solved exactly. Fourier transforms are used for a solution involving a minimum of boundary conditions. The boundary conditions chosen enable either the drawdown to be determined from the outflow, or the flow to be determined if the drawdown is known as a function of time at any distance from the well. For both cases, the aquifer characteristics must be known. In the limit where the well radius is small and the flow rate constant, the solution is shown to generate the Theis equation. The general solution presented is applicable to any problem where the discharge is a known function of time. The technique discussed should be readily applicable to more complex cases.

R203253X68A

Wigley, T M L

FLOW INTO A FINITE WELL WITH ARBITRARY DISCHARGE

J of Hydrol, Vol 6, No 2, pp 209-213, Apr 1968. 5 p, 5 ref

University of Adelaide, Australia

DESCRIPTORS--/ drawdown/ hydraulic conductivity/ hydrodynamics/ *aquifer characteristics/ *Theis equation/ *transmissivity/ *mathematical models/ mathematical studies/ *groundwater movement/ equations/ *groundwater/ flow rates/ *water wells

IDENTIFIERS--/ *finite-radius wells/ pumping tests

R203257 68A MAPPING VERTICAL VARIABILITY OF AQUIFERS
The distribution of fresh-water sands within the total fresh-water section can be considered as an irregular frequency distribution; then employing the method of moments a description of smooth distribution is obtained using the first 4 moments to calculate the following 4 statistical measures: center of gravity (weighted average), standard deviation, skewness, and kurtosis. Assuming statistical measures are continuous functions, each can be contoured to show areal distribution. Reliable data from 110 wells provided sufficient control to contour 4 areas with different geologic conditions in Mississippi. Center of gravity and standard deviation produced relatively simple contour maps to reflect simple contour patterns. Skewness and kurtosis did not produce maps with simple contour patterns, and in most of the areas mapped, values indicate that smoothed distribution is not a normal probability distribution. This implies that all 4 statistical measures must be used to make statistical inferences with confidence. Although statistical maps provide only part of a series required to evaluate fresh-water sections adequately, they may have practical application in planning ground-water developments, and estimating depth for test holes so a significant part of fresh-water section should reasonably be tested.

R203257 68A

Keady, Donald M

APPLICATION OF MOMENTS TO MAPPING THE VERTICAL VARIABILITY OF THE AQUIFER SYSTEMS IN MISSISSIPPI

Water Res Inst Rep, Mississippi State Univ, 1968. 31 p, 8 fig, 1 tab, 11 ref, 2 append

Mississippi State University, State College

DESCRIPTORS--/ *aquifers/ geomorphology/ distribution/ mapping/ wells/ *water sources/ *statistical analysis/ fresh water/ *ground water/ sands/ hydrogeology/ statistical methods/ Mississippi/ aquifer characteristics/ logging (recording)

IDENTIFIERS--/ standard deviation

R203261 68A STATISTICAL POROUS MEDIA HYDRODYNAMICS
An investigation was made of the stochastic aspects of single and multiple phase flow through porous media. The complete correspondence between transport theory and thermodynamics has been established, and the corollaries of the thermodynamic stability conditions in transport theory have been investigated. A further development of the usual correspondence between transported quantities and thermodynamics has been obtained by an attempt to extend the theory to nonpositive definite transported quantities. The theory has then been applied to flow through porous media, as exemplified by ground-water flow. A general investigation has been made of the possibility of the development of a steady state in frontal displacement processes in porous media with and without fingers, with the result that stabilization appears impossible. Finally, a new type of statistical model for flow through porous media was investigated, based on a random ensemble of topological graphs. Has 16 references.

R203261 68A

Scheidegger, A E

STATISTICAL POROUS MEDIA HYDRODYNAMICS

Res Rep 17, Univ Illinois, July 1968. 70 p, 5 fig, 1 tab, 16 ref

University of Illinois, Urbana

DESCRIPTORS--/ fluid flow/ *hydrodynamics/ *porous materials/ *ground water/ thermodynamics/ groundwater flow/ dispersion/ bibliographies/ statistical analysis/ *porous media/ stochastic processes/ statistical models

IDENTIFIERS--

R203263 67A MOVEMENT OF MICRON-SIZE PARTICLES THROUGH A SAND BED
Movement of certain radioactive ions and other impurities over considerable distances through underground aquifers is of great interest in areas where control of radioactive waste and other environmental pollutants is a concern. To study this phenomenon, scandium-46 was adsorbed to micron-size kaolin particles dispersed in water and the suspension was allowed to percolate slowly through a horizontal packed bed of sand 2 m long, 1 m wide, and 0.25 m thick which served as a model aquifer. Continuous analyses of the effluent for particulate load, dissolved ions, and radioactivity showed that a finite fraction of radioactively labeled particles, approximately 0.025%, was carried through the bed. Also, lateral scanning and vertical coring of the sand bed, after completion of the test, showed that the bulk of the radioactive particles had been removed by filter action within the first 10 cm of packed sand bed. Experiments established that it is possible for suspended micron-size particles in flowing water to compete with the ion exchange processes on sand particle surfaces for trivalent ions, such as scandium and ruthenium, and to transport them large distances through an aquifer. This mechanism helps to explain the apparently anomalous mobility of ruthenium from reactor fuel waste disposal areas. Has 48 references.

R203263 67A

Champlin, Jerry B G

THE MOVEMENT OF MICRON-SIZE PARTICLES THROUGH A SAND BED

Water Resour Center Rep WRC-0867, Georgia Inst Technol, Dec 1967. 106 p, 20 fig, 6 tab, 48 ref

Georgia Institute of Technology, Atlanta

DESCRIPTORS--/ *aquifers/ ions/ *radioactive contamination/ percolation/ bibliographies/ model tests/ filters (fluid)/ filtration/ tracers/ water pollution/ sands/ capillarity/ sensors/ *radioactive wastes/ groundwater movement/ ground water/ *groundwater flow/ *radioactive waste disposal

IDENTIFIERS--

R203267 67A CATIONS IN GROUND WATER
This is the first study of the trace-element content of subsurface water in a petrologically complex metamorphic terrain. A correlation exists between the enclosing rock type and the trace-element content of the ground water. The limited data presented indicate that ground water quickly changes character with a change in enclosing rock type. Twelve wells were analyzed for Ca, Mg, Zn, Cu, Fe, and Mn by atomic-absorption spectrophotometry. Analyses began in December 1965, and continued until July 1966. Well water temperature and regional rainfall were also measured and tabulated. Seasonal variations have a pronounced effect upon the trace-element content. These changes result from variations in temperature, rainfall amount, and, very likely, the rate of organic activity. Results of this investigation show the following: (1) the quantitative dependence of ground-water trace constituents to enclosing rock type; (2) the adjustment of migrating ground water to contrasting lithologies; (3) the quantitative variations in ground-water compositions with seasonal and rainfall variations; and (4) the possible relation between specific trace-element contents and organic activity.

R203267 67A

Salotti, Charles A and Fouts, James A

SPECIFIC CATIONS IN GROUND WATERS RELATED TO GEOLOGIC FORMATIONS IN THE BROAD QUADRANGLE, GEORGIA

Geol Surv Bull No 78, Ga State Div Conserv, 1967. 34 p, 6 fig, 5 tab, 10 ref, 4 append

Georgia State Division of Conservation and Georgia Institute of Technology, Atlanta

DESCRIPTORS--/ *groundwater flow/ subsurface investigations/ mineralogy/ geological surveys/ wells/ sampling/ petrology/ chemical analysis/ water analysis/ *ground water/ minerals/ geologic formations/ *trace elements/ *tracers/ geochemistry/ subsurface waters/ geologic mapping/ Georgia/ spectrometers
IDENTIFIERS--/ geologic maps

R203274 68A WATER-WELL DATA, TOWNSHIPS 11-25, ALBERTA
Data recorded through December 31, 1964, and some for 1966 are presented for about 3,000 wells in the southern part of Alberta (townships 11-25). Well information given includes location, physical description, year drilled, depth to water, aquifer, yield, water quality, a log if available, and other pertinent data.

R203274 68A

Geiger, K W; De Vries, P H; Withers, D W

WATER-WELL RECORDS, ALBERTA TOWNSHIPS 11-25

Res Counc Alberta Rep 66-4, Dec 1968, 136 p, 1 fig, 2 tab

Research Council of Alberta, Edmonton, Canada

DESCRIPTORS--/ *aquifers/ foreign countries/ water yield/ water quality/ water utilization/ water table/ *groundwater/ *water wells/ hydrologic properties/ water levels/ hydrogeology/ data collections/ subsurface waters/ Canada

IDENTIFIERS--/ *well data/ well yield

R203276 67A RADIOACTIVE ELEMENTS IN AN AQUIFER
Radioactive solutions were injected into a model aquifer containing 1600 pounds of sand with dimensions of 1 by 2 by 0.25 meters. Radioactive solutions were injected into a model aquifer containing 1600 pounds of sand with dimensions of 1 by 2 by 0.25 meters. Radioactive sodium-24 was dissolved in dilute sodium chloride solution and passed into the aquifer where it displaced fresh water which had saturated the sand. Analyses were made on the effluent for sodium, potassium, and calcium by flame analyses; for particulate size distribution and concentration with a Coulter counter; and for radioactivity with scintillation detectors. As the activity passed through the sand, its progress was followed by use of a collimated Geiger-Muller tube on the exterior of the bed. Arrival of the radioactivity and an increase in the particulate matter suspended in the effluent. Corresponded with relatively sharp conductivity, pH, pK, and pCa change which marked the arrival of the sodium front. The sodium and the ruthenium studies indicated that significant amounts of radioactive ions were transported through the test bed on particulate matter which is large enough to be trapped on 0.45 micron membrane filters. Has 20 references.

R203276 67A

Champlin, J B F and Eicholz, G G

THE MOVEMENT OF RADIOACTIVE SODIUM AND RUTHENIUM THROUGH A SIMULATED AQUIFER

Pap, Georgia Inst Technol, 1967. 23 p, 6 fig, 20 ref

Georgia Institute of Technology, Atlanta

DESCRIPTORS--/ *aquifers/ ions/ *radioactive contamination/ percolation/ bibliographies/ model tests/ filters (fluid)/ filtration/ tracers/ water pollution/ capillarity/ sensors/ *radioactive wastes/ ground water/ *groundwater flow/ *radioactive waste disposal/ groundwater movement/ sands/ sodium/ simulation
IDENTIFIERS--

R203279 68A EFFECTS OF IRRIGATION PUMPING, DIAMOND VALLEY, NEVADA
An appraisal of the effects of pumping during 1950-65 indicates that groundwater storage in the valley was depleted by about 60,000 acre-ft. This is roughly the net pumpage for the period but is only 3% of water in storage in the upper 100 ft of saturated valley-fill. Annual recharge is estimated at 30,000 acre-ft--21,000 from precipitation and 9,000 from inflow. Natural discharge is 30,000 acre-ft--5,000 by evaporation from a playa in the northern half of the basin and 25,000 by evapotranspiration. Pumpage, concentrated in the southern half of the valley, was 12,000 acre-ft in 1965, but permits have been granted for 150,000 acre-ft/yr. At 1965 rate, depletion would have to be 3 million acre-ft to establish a new groundwater equilibrium. Water quality is good now but may deteriorate from recycling of water or migration of poor quality water from the playa. The aquifer in the southern half of the valley has 20 to 80 ft of gravel in the upper 100 ft, a transmissibility coefficient of 50,000 to about 100,000 gpd/ft, and a natural depth to water of 20 to 120 ft. Maps show distribution of geologic units and phreatophytes, contours on the water table in 1950 and 1966, and decline of water levels in that interval. Tables give data on runoff, chemical analyses, wells, and drillers logs.

R203279 68A

Harrill, J R and Lamke, R D

HYDROLOGIC RESPONSE TO IRRIGATION PUMPING IN DIAMOND VALLEY, EUREKA AND ELKO COUNTIES, NEVADA, 1950-65, with a section on SURFACE WATER, by R D Lamke

Nev Dep Conserv Natur Resour Water Resour Bull 35, 1968. 108 p, 17 fig, 3 plate, 21 tab, 51 ref

State of Nevada Department of Conservation and Natural Resources

DESCRIPTORS--/ *groundwater recharge/ water quality/ evapotranspiration/ geologic formations/ water utilization/ phreatophytes/ *aquifers/ water sources/ *groundwater/ Nevada/ irrigation water/ *hydrogeology/ areal/ discharge (water)/ withdrawal/ *hydrologic budget/ water supply/ transmissivity/ pumping/ hydrologic properties
IDENTIFIERS--/ *depletion/ pumpage/ alluvial aquifers/ water level fluctuations/ storage depletion/ inflow

R203281 68A GROUND WATER RESOURCES IN CONNECTICUT
A hydrogeologic appraisal of the 127-sq-mi Hamden-Wallingford area, Connecticut, reveals that present withdrawals total 4 billion gal/yr from several aquifers. This is only 15% of the ground-water supply potentially available. Large recharge potential is offered by the Quinnipiac and Mill Rivers. Therefore, upper limits of ground-water development can be set by distribution of thick permeable glacial materials, particularly ice-contract deposits, Through these, wells can induce infiltrate from surface streams. Quality of all aquifer waters is good; dissolved solids content ranges from 40 to 250 ppm. Well yields range from a few gallons a minute for glacial till to as much as 1750 gpm for the coarse-grained, ice-contact deposits. Glacial lake deposits are fine grained and low in permeability. They yield small water supplies and at places form a leaky aquiclude over aquifers in ice-contact deposits. Large scale topographic base maps show geology, data wells, water table contours, saturated thickness of unconsolidated deposits, and areas favorable for artificial recharge. Has 21 references.

R203281 68A

LaSala, A M, Jr

GROUNDWATER RESOURCES, HAMDEN-WALLINGFORD AREA, CONNECTICUT

Conn Water Resour Bull 14, 1968. 20 p, 5 fig, 5 tab, 21 ref

Connecticut Water Resources Commission and Geological Survey

DESCRIPTORS--/ aquifers/ seepage/ chemical analysis/ hydrographs/ till/ permeability/ aquicludes/ water utilization/ bibliographies/ geologic mapping/ *geohydrologic units/ *aquifer characteristics/ groundwater movement/ *surface-groundwater relationships/ *glacial drift/ induced infiltration/ Connecticut/ natural recharge
IDENTIFIERS--/ *unconsolidated deposits/ *groundwater potential/ glacial till

R203047X68A BPA'S 800-KV D-C TRANSMISSION LINES
Portions of the 2 Pacific Intertie d-c lines built by the Bonneville Power Administration (BPA) are described; each constitutes 1/3 of the total length. The lines will have a capacity larger than any previous d-c line and a total length of over 800 mi, far greater than any existing a-c or d-c circuit. The first Pacific Intertie d-c line was designed without benefit of operating data from other overhead d-c lines, and similar operating data still were very limited when criteria were being formalized for the second line. The constructing agencies were forced to base criteria on test information collected at the BPA d-c test center, plus any deductions that could be based properly on a-c experience. The later scheduling of the second line allowed time for additional tests and studies. These tests suggested that criteria less conservative than those used on the first line could be adopted safely for the second, with some cost savings. Design criteria are tabulated and compared, and the derivations are examined. Has 15 references.

R203047X68A

Annestrand, S A; Harrington, E J; Marjerrison, M N; et al

800 KV DC TRANSMISSION LINES OF THE BONNEVILLE POWER ADMINISTRATION

Proc, Western Water Power Symp, pp D-35-D-52, Apr 1968. 18 p, 6 fig, 1 tab, 15 ref

Bonneville Power Administration, Portland, Oreg

DESCRIPTORS--/ *extra high voltage/ direct currents/ bibliographies/ transmission (electrical)/ *transmission lines/ design criteria/ costs/ extra long distance/ electric power/ electric insulation/ lightning/ radio interference/ clearances/ transmission towers/ safety/ design/ electrical grounding/ electrodes
IDENTIFIERS-- / electrical design/ electrical insulators/ overvoltage/ Pacific NW-SW Intertie/ overhead ground wire/ National Elec Safety Code

R203054X68A GENERATOR WINDING--PREVENTIVE MAINTENANCE
A program was developed for preventive maintenance on hydroelectric generator windings. The program is intended to provide a practical method for determining the condition and reliability of the winding insulation, revealing maintenance techniques necessary to lengthen the winding life, and sssuring reliable operation from 1 test and maintenance period to another. The annual maintenance check consists of: (1) a complete physical inspection; (2) a combination dielectric absorption and d-c overpotential test on winding, field, and exciter; (3) an a-c voltage drop test on field poles; (4) a high-current resistance test on field pole connections; and (5) a slot discharge test made immediately prior to shutdown. The program has been developed over the years and is the result of many investigations and trials of various test methods. Numerous adaptations have been extended to other areas such as rolling mill equipment, and the applicable experiences have been incorporated in the program. Has 19 references.

R203054X68A

Warren, Mead Jr and Butterworth, Chester I

A PREVENTIVE MAINTENANCE PROGRAM FOR HYDROELECTRIC GENERATOR WINDINGS

Inst Elec Electron Eng Trans Power App Syst, Vol PAS-87, No 5, pp 1283-1288, May 1968. 6 p, 7 fig, 2 tab, 19 ref, disc

Aluminum Company of America, Alcoa, Tenn

DESCRIPTORS-/ *maintenance/ *electric generators/ reliability/ leakage/ inspection/ *deterioration/ faults (electrical)/ bibliographies/ direct currents/ *electric insulation/ electrical coronas/ electric potential/ alternating currents/ *power O&M/ test procedures/ hydroelectric powerplants
IDENTIFIERS-/ *dielectric properties/ leakage current/ rotating machines/ overvoltage/ *windings (electrical)/ preventive maintenance/ stators

R203055X68A TVA'S RI EXPERIENCE ON 500-KV LINES
TVA began a comprehensive radio noise (RI) evaluation program in 1963 with a study of RI and radio field strengths (RIV) along the edge of transmission line right-of-way. Tests have included RI surveys with portable instruments covering the AM broadcast, FM, and TV bands; RI and RIV measurements in substations; and continuous recordings at 2 fixed RI stations. The tentative goal initially set for maximum RI 100 ft from TVA's 500-kv lines during fair weather was 50 microvolts/m (34 dB). Accumulated test data indicate that averages are below this level. The paper discusses instruments, antennas, and types of surveys; design and development of RI monitoring stations; and comparisons of the relative merits of various supplementary items. Results from RI profiles, RIV measurements, and monitor station recordings are analyzed and presented, along with brief discussions of signal-to-noise ratios and evaluation of TVA's transmission line design and construction techniques. All test procedures and evaluation methods have followed recommendations of the Radio Noise Subcommittee of the IEEE Transmission and Distribution Committee wherever applicable.

R203055X68A

Hartley, James W; Smith, Robert T; Dobson, Herbert I

TENNESSEE VALLEY AUTHORITY'S RADIO INTERFERENCE EXPERIENCES ON 500-KV TRANSMISSION LINES

Inst Elec Electron Eng Trans Power App Syst, Vol PAS-87, No 4, pp 903-911, Apr 1968. 9 p, 14 fig, 9 ref, disc

Tennessee Valley Authority, Chattanooga

DESCRIPTORS-/ *transmission lines/ *extra high voltage/ instrumentation/ *radio interference/ *noise/ weather/ antennas/ test procedures/ aging/ test facilities/ investigations/ electrical coronas/ contamination/ atmospheric precipitation/ electrical equipment/ rainfall

IDENTIFIERS-/ evaluation/ test results/ testing equipment/ signal to noise ratio/ electric conductors/ Tennessee Valley Authority

R203062X68A NUCLEAR POWER BUILDUP GOES CRITICAL
This paper reviews the chain reaction underway in nuclear powerplant construction, and the way power is assuming new importance in manufacturing, especially in the chemical industry. Utilities seek nuclear energy as the route to lower power costs, possibly 1 to 1.4 mils/kwh by 2020, compared with present costs of 3 to over 5 mils/kwh. Low-cost power can permit a freedom in development of new processes and in site selection heretofore unknown, and great savings can be made in processes presently using electricity. Low-cost power would furnish incentive to use electricity to perform many industrial processes in an energy-intensive manner; energy would be substituted for raw materials such as coke or natural gas, or for reducing high-quality ores having uneven or inconsistent geographic distribution. The projections of nuclear power's growth and low cost are based on performance of small plants now operating and estimates of plants under construction. Many estimates include plants existing only in the dreams of nuclear economists.

R203062X68A

Short, Herbert C

NUCLEAR POWER BUILDUP GOES CRITICAL

Chem Week, Vol 102, No 21, pp 44-61, May 1968. 18 p, 14 fig, 4 photo

Chemical Week, New York, N Y

DESCRIPTORS--/ *nuclear powerplants/ *nuclear energy/ industries/ cost comparisons/ costs/ manufacturing/ economics/ reviews/ chemistry/ coal/ public utilities/ safety/ forecasting/ electric power production/ electric power industries/ electric power demand/ energy

IDENTIFIERS--/ *nuclear engineering/ *nuclear power/ nuclear fuels/ nuclear reactors/ fossil fuels

R203087X78A RESULTS OF TESTS ON 400-KV LINES
During commissioning of the first 2 Czechoslovak 400-kv transmission lines, special attention was given to overvoltages occurring under normal and fault conditions. Purpose of the study was to obtain information for the future operation of the 400-kv system, and for establishing parameters to be demanded of power apparatus in the next stage of development of the ehv systems. Experimental work consisted of stage tests and investigations on a transient network analyzer. The following stage tests were made: switching a 400-mva autotransformer, at no load and when loaded with a compensating shunt reactor on the tertiary side; switching of 90-mvar shunt reactors; switching of 400-kv lines at no load; connecting and disconnecting one section of a 400-kv line to or from another energized section; switching a 400-kv line with an unloaded autotransformer connected to the receiving end; switching a 400-kv line with an autotransformer and a shunt reactor connected to the receiving end; switching an autotransformer/400-kv line block on the 220-kv side of the transformer, in different alternatives; single-pole switching of the transmission system; and switching a 400-kv line under line-to-ground fault conditions. Test results are given.

R203087X68A

Gert, Richard

RESULTS OF TESTS ON 400-KV TRANSMISSION LINES

Tech Digest, Vol 10, No 5, pp 291-298, May 1968. 8 p, 10 fig, 4 tab, 7 ref

Power Research Institute, Brno, Czechoslovakia

DESCRIPTORS--/ *extra high voltage/ *transmission lines/ *field tests/ power transformers/ experimental data/ electric power/ instrumentation/ test procedures/ circuit breakers/ transients/ electric currents/ power system operations/ electric potential/ alternating currents/ electric insulation/ faults (electrical)/ electrical stability/ coordination
IDENTIFIERS--/ *switching/ test results/ Czechoslovakia/ shunt reactors/ foreign research/ *network analysis/ switching surges/ overvoltage

R203104 68A VOLGOGRAD-DONBASS 800-KV D-C LINE
Experience in operating the 500-km, 750-mw, 800-kv, Volgograd-Donbass overhead d-c transmission line has been important in development of new, longer, higher voltage transmission lines in the USSR. Several contributions for creating reliable extra long and extra high voltage d-c transmission lines include: (1) analyzing the research and engineering solutions used in the design; (2) experience in adjusting and testing mercury arc valves and other special equipment; (3) control; (4) protection and automation; and (5) results of experimental investigations made on the transmission line. The design of the 2500-km, 1500-kv, 6000-mw Kasakhstan-Center d-c transmission line is based on these operating experiences. A discussion is included of: (1) series-connected valve bridges, (2) mercury-arc valves, (3) valve bridges, (4) automatic control, and (5) grounding. Recommendations are included for tower structures and line insulation.

R203104 68A

Berkovski, A M; Butaev, F I; Grois, E S; et al

OPERATING EXPERIENCE OF THE VOLGOGRAD-DONBASS DC TRANSMISSION LINE AND ITS APPLICATIONS TO EXTRA HIGH VOLTAGE DC HIGH CAPACITY TRANSMISSION

Pap, Int Conf Large High Tension Elec Syst, Paris, France, June 1968. 7 p, 3 fig, 4 ref

DESCRIPTORS--/ *extra high voltage/ extra long distance/ control/ field tests/ *transmission lines/ *direct currents/ transmission (electrical)/ foreign construction/ radio interference/ operations/ electric currents/ electric insulation/ transmission towers/ rectifiers/ electrical grounding/ automatic control/ converters (electrical)
IDENTIFIERS--/ *Volgograd-Donbass Line USSR/ USSR/ foreign research/ protection (electrical)

R203105 68A TRANSFORMER INRUSH CURRENT
Transformer inrush currents have caused difficulties principally in hvdc converter stations, but interference with relays and communication circuits also has been a problem. This report discusses the influence of various factors on the magnitude of inrush currents against a background of field tests, model tests, digital computer calculations, and analog computer measurements. After disconnecting a transformer the remanent flux is high in 2 of the phases. Under certain conditions delta windings appreciably reduce the zero-sequence components of inrush currents. Certain measures to reduce relay and communication problems are discussed. The effectiveness of preinsertion resistors is emphasized and rules for design of these resistors are given. Particular problems can arise in the case of 2 transformers with a common breaker, even when preinsertion resistors are used.

R203105 68A

Holmgrem, B; Jenkins, R S; Riubrugent, J

TRANSFORMER INRUSH CURRENT

Pap, Int Conf Large High Tension Elec Syst, Paris, France, June 1968. 13 p, 6 fig, 2 tab, 5 ref, 3 append

Swedish State Power Board and ASEA, Sweden

DESCRIPTORS--/ *power transformers/ extra high voltage/ communications/ direct currents/ *electric currents/ electric relays/ computers/ peak values/ circuit breakers/ electrical equipment/ field tests/ resistors/ calculations/ converters (electrical)/ magnetic fields/ investigations/ electric potential/ electrical grounding
IDENTIFIERS--/ foreign research/ Sweden/ flux density/ *transformer inrush current

R203106 68A DIRECT COOLING OF WATER-WHEEL GENERATORS

A large water-wheel generator, rated 225 mva at 200 rpm, and direct cooled with water in the stator winding, stator core, and rotor winding, has been commissioned by the Swedish State Power Board at the Seitevare Powerplant. Application of intensive cooling of this type provides an opportunity for making generators with higher outputs and optimizing the design relative to different parameters because of the requirements or economic evaluation of the system engineer and the plant designer. The total cost of the power station or pumped storage plant can be reduced when generator manufacturing costs are lowered and dimensions and weight of the generator can be adapted to the lowest building height, width, and crane capacity. Losses, reactances, and stored energy constant also can be influenced. Development work accomplished during the last 4 yr on direct water cooled units is reviewed.

R203106 68A

Tengstrand, C and Ronnevig, C

DIRECT COOLING OF WATER-WHEEL GENERATORS, INFLUENCE ON DIMENSIONS AND GENERATOR PARAMETERS

Pap, Int Conf Large High Tension Elec Syst, Paris, France, June 1968. 8 p, 4 fig, 2 tab

ASEA, Vasteras, Sweden

DESCRIPTORS--/ *hydroelectric power/ *electric generators/ economics/ losses/ *cooling water/ costs/ weight/ design criteria/ stress/ energy/ foreign design practices/ manufacturing/ moments of inertia/ *cooling/ magnetic properties

IDENTIFIERS--/ *rotors/ *stators/ Sweden/ Seitevare Pwrplt, Sweden/ reactance/ flux density

R203107 68A STUDY OF BUNDLED CONDUCTOR OSCILLATION

Great Britain's Central Electricity Generating Board conducted a study of conductor vibration in bundled conductor transmission lines on a test line in Scotland. A discussion is presented on: (1) mechanical configuration of the test line, (2) location, (3) conductor details, (4) instrumentation, and (5) data recording systems. Test results are tabulated and weather conditions at time data were obtained are given. Observations made between June 30, 1964 and Jan 14, 1965 are summarized. The test line provided valuable data on the behavior of 275- and 400-kv bundled conductor construction. Galloping occurred infrequently and only during winter months when temperatures were near freezing, snow was falling, and strong winds were blowing across the line. The galloping experienced on the bundled conductor lines was due to ice formation. Subconductor vibration, a serious problem difficult to prevent, occurs frequently and causes extensive damage to conductors and spacers. Using flexible damper spacers is the most hopeful approach to solving subconductor vibration.

R203107 68A

Rissone, R F; Aldham-Hughes, R R; Wilton, G S; et al

AN EXPERIMENTAL STUDY OF BUNDLED CONDUCTOR OSCILLATION

Pap, Int Conf Large High Tension Elec Syst, Paris, France, June 1968. 15 p, 6 fig, 3 tab, 5 ref

Central Electricity Research Laboratories and South of Scotland Electricity Board, Great Britain

DESCRIPTORS--/ *vibrations/ *vibration suppressors/ dampers/ ice loads/ *oscillation/ *transmission lines/ *bundled conductors/ aerodynamics/ wind (meteorology)/ field tests/ instrumentation/ mechanical properties/ photography/ experimental data/ analysis/ weather/ snow/ storms/ ice/ extra high voltage/ laboratory tests

IDENTIFIERS--/ *electric conductors/ *galloping conductors/ amplitude/ foreign research/ Great Britain/ *aeolian vibration

ELECTRICAL ENGINEERING

R203108 68A POLYETHYLENE-INSULATED HIGH-VOLTAGE CABLE
A simplified concept for design of insulated power cables for 115- to 138-kv operation is presented. The cables are insulated with a voltage-stabilized low-melt index polyethylene compound. Cable construction details, electrical ratings, dimensions, and other data are given for 4 underground and 1 submarine 115- to 138-kv installations. The insulant and the cables are evaluated based on data from voltage-time and load cycle tests. Heat fused methods are described for splicing cables and making end terminals. The 5 cable installations are discussed, with cable data, type of circuit and rating, installation, and operational data provided for each. Evaluation tests of these 5 installations demonstrate the practicability of 115- to 138-kv polyethylene-insulated power cables.

R203108 68A

Kenney, N D and Koulopoulos, M J

115 KV AND 138 KV POLYETHYLENE-INSULATED CABLE INSTALLATIONS AND CABLE EVALUATION DATA

Pap, Int Conf Large High Tension Elec Syst, Paris, France, June 1968. 12 p, 1 fig, 6 tab, 4 ref

Simplex Wire and Cable Co, Cambridge, Mass

DESCRIPTORS--/ *electric cables/ *electric insulation/ *polyethylenes/ electric power/ electric potential/ shielding/ dielectrics/ circuits/ test procedures/ installation/ operations/ power system operations/ electric currents/ electrical properties/ transmission (electrical)/ losses
IDENTIFIERS--/ buried cables/ *underground cables/ *submarine cables/ electric conductors/ cable terminations/ evaluation

FOUNDATIONS

R203035X68A PILE FOUNDATION ANALYSIS
Analysis of pile foundations is accomplished by calculation of the stiffness influence coefficients. Piling loads and deflections can be determined, as well as the principal frequencies. Axial and torsional elastic constants for a pile may be adjusted to the physical problem; the torsional constant has negligible effect and usually may be ignored. The elastic constants dependent on bending may be derived in several ways including tests or physical models based on an assumed behavior of the system such as: (1) a semi-infinite beam on an elastic foundation, (2) a free cantilever fixed at an assumed depth, or (3) a free cantilever fixed to a semi-infinite beam on an elastic foundation. The stiffness influence coefficients may be formed from simple matrices defining elastic constants and position or from a list of equations. Has 28 references.

R203035X68A

Saul, William E

STATIC AND DYNAMIC ANALYSIS OF PILE FOUNDATIONS

Proc Amer Soc Civil Eng, J Struct Div, Vol 94, No ST5, pp 1077-1100, May 1968. 24 p, 7 fig, 6 tab, 28 ref, 4 append

DESCRIPTORS--/ *pile foundations/ *piles/ structural engineering/ pile driving/ live loads/ *structural analysis/ elastic deformation/ dead loads/ dynamics/ computer programming/ deflection/ bibliographies/ analysis/ foundations/ lateral forces/ stiffness

IDENTIFIERS--/ elastic foundations/ pile tests

R203040 68A REVIEW OF TUNNEL SITE INVESTIGATIONS
The engineering geology profession faces a formidable challenge in providing designers and builders of tunnels with: (1) precise geological knowledge of tunnel sites, (2) effects of geologic conditions, (3) quantities of water and gas to be encountered, (4) strength and stability of the rock, and (5) support and lining requirements. This paper reviews current methods of producing required data on the tunnel site in the preconstruction stage. Consideration is directed toward constructing a free-flow tunnel in fractured rock formations without any requirements for the rock-mechanics type of in situ tests usually made for pressure tunnels or large underground openings. Preliminary office studies, on-site investigations, geophysical surveys, drill holes, exploration excavations, and laboratory tests are discussed. Factors involved in making geologic predictions include physical obstacles and shortage of time and money. Experience indicates present technology is not used fully, and a more realistic allocation of time, money, and qualified personnel is required to achieve the best results. The immediate opportunity for improvement of those results relies more on developing men whose judgment determines the answer and less on developing additional tests for seemingly precise data on minute samples. Has 15 ref.

R203040 68A

Gardner, William I

TUNNEL SITE INVESTIGATIONS--A REVIEW

Pap, Conf Tunnel Shaft Excavation, Univ Minnesota, Minneapolis, May 1968. 12 p, 15 ref

Bureau of Reclamation, Denver, Colo

DESCRIPTORS--/ bibliographies/ *engineering geology/ geology/ *geologic investigations/ *subsurface investigations/ petrographic investigations/ *tunnels/ tunnel design/ tunnel construction/ explorations/ geophysics/ drill holes/ rock excavation/ rocks/ mapping/ ground water/ training/ reviews/ laboratory tests
IDENTIFIERS--/ *site selection/ rock properties/ *tunnel supports/ geologic maps/ geologic defects

R203078 68A EARTHQUAKES IN WESTERN STATES
Earthquake maps of the Western United States, including Alaska and Hawaii, were prepared showing epicenter locations and earthquake intensities. Data were assembled by the Bureau of Reclamation from U S Coast and Geodetic Survey publications and compiled as a reference on relative seismicity of the western states. The report does not contain information for estimating structural loadings produced by earthquake vibrations. Earthquake intensity and magnitude scales are explained. Ten maps are included.

R203078 68A

Anon

EARTHQUAKE IN WESTERN UNITED STATES

Bur Reclam Dams Br Rep DD-8, Apr 1968. 23 p, 10 fig, 3 tab, 2 ref

Bureau of Reclamation, Denver, Colo

DESCRIPTORS--/ *earthquakes/ seismic design/ seismic investigations/ *seismology/ geophysics/ engineering geology/ vibrations/ scale/ maps/ intensity/ design criteria

IDENTIFIERS--/ earthquake engineering/ earthquake focus/ *earthquake zones/ *epicenters/ magnitude/ Western United States/ Alaska/ Hawaii

R203123X67A A DESERT GLOSSARY
A compilation of current terms describing desert features and desert phenomena is presented. An attempt was made to simpligy and consolidate the terminology used in describing deserts. Entries in the glossary were largely physiographic and geographic, but botanical, pedological, meteorological, climatological and several archaeological terms are included. The glossary is presented in two parts. In the first section, which is the more complete, the deserts of Mexico and the United States are grouped together. The second section consists of terminology applied to deserts in Arabia, Australia, Central Asia, Chile and Peru, Egypt, Iraq, Jordan, Pakistan, Iran, Southwest Africa, and Syria. Has 32 references.

R203123X67A

Stone, Richard O

A DESERT GLOSSARY

Eath-Sci Rev, Vol 3, No 4, pp 211-268, Dec 1967. 58 p, 37 fig, 32 ref

University of Southern California, Department of Geology, Los Angeles

DESCRIPTORS--/ dune sands/ plant (botany)/ alluvial deposits/ *arid lands/ dunes/ Southwest U.S./ soils/ meteorology/ climatology/ plants/ geomorphology/ bibliographies/ weathering/ *deserts/ geology

IDENTIFIERS--/ *glossaries

R203142 68A BURRO MOUNTAIN ULTRAMAFIC BODY
The author describes the lithology, structure and emplacement of the Burro Mountain body in the Santa Lucia Range, California located about 60 mi southeast of Monterey Bay. This body forms a block 1 x 1.5 mi on a side, is typically ultramafic in character, and consists of approximately 65% peridotite, 35% dunite and less than 1% pseudopyroxenite. It is emplaced in highly sheared Franciscan terrane west of Nacimiento fault. The fault separates 2 major structural units: on the east a 40- by 300-mi block with a basement of granitic rock, schists and gneisses, and on the west a 10- by 100-mi tract of Franciscan Formation. The area was chosen for study because of the excellent exposures and a steep gorge transecting the center of the body which revealed the internal structure. In addition to field mapping some 270 oriented cores were secured--using a portable drill--that represented every ultramafic lithology along a 2-mi traverse through the body. Serpentinization was nearly complete near the margins of the body and decreased toward the center. Evidence suggests a subcrustal origin for the primary ultramafic rock. Has 32 references.

R203142 68A

Burch, Stephen H

TECTONIC EMPLACEMENT OF THE BURRO MOUNTAIN ULTRAMAFIC BODY, SANTA LUCIA RANGE, CALIFORNIA

Geol Soc Amer Bull, Vol 79, No 5, pp 527-537, May 1968. 15 p, 3 fig, 4 plate, 2 tab, 32 ref

Geological Survey, Menlo Park, Calif

DESCRIPTORS-/ geological surveys/ petrographic investigations/ cores/ metamorphic rocks/ serpentine/ core drilling/ granites/ schists/ *petrology/ *igneous rocks/ geology/ geologic formations/ geologic investigations/ bibliographies/ mineralogy/ structural geology

IDENTIFIERS-/ Santa Lucia Range, Calif/ Burro Mountain, Calif/ *ultrabasic rock/ peridotite/ tectonics

R203147 67A GAMMA-GAMMA LOGGING OF DRILL HOLES
Gamma-gamma drill hole logging measures the intensity of scattered gamma radiation in rock irradiated by a gamma source. Such logging can be used to determine quantitatively the density of the rock and its lithology and porosity. The scattered gamma radiation is a function of several parameters: (1) rock density, (2) density of the drill hole fluid, (3) radius of the drill hole, (4) shielding of the iron jacket of the gamma ray detecting device used in the drill hole, and (5) distance between the gamma ray source and the detector. The relationship between the gamma ray intensity and the density of the rock is determined by a diffusion equation for the absorbing medium. This equation and other equations required are presented and discussed in detail.

R203147 67A

Diad'kin, I G

ON THE THEORY OF GAMMA-GAMMA LOGGING OF DRILL HOLES

Bur Reclam Transl 710, July 1967. 17 p, 2 fig, 7 ref

Bureau of Reclamation, Denver, Colo

DESCRIPTORS-/ *logging/ *gamma rays/ radiation measurement/ density/ drill holes/ boreholes/ geophysics/ geologic investigations/ diffusion/ engineering geology/ subsurface investigations/ scattering/ radioactive well logging/ borehole geophysics

IDENTIFIERS-/ rock properties/ Compton scattering/ gamma probes/ well logging/ *gamma-gamma logging

R203148 67A SIGNALS RECORDED IN DEEP SEISMIC SOUNDING
Experimental data on useful signal magnitudes for longitudinal waves recorded in deep seismic soundings (DSS) are summarized. Standard explosive charges of 130 kg of TNT for measurements at sea and 1000 kg of TNT for seismic work on land were used. The most sensitive parameter of seismic waves was found to be their amplitude which can now be measured in absolute units of displacement, velocity, or pressure. This permits comparison of results in different geographic areas and with different seismic apparatus. A strict calibration of the seismic channel is required. Signals observed in DSS and in (earthquake) seismology can be compared and the possibilities of combining the 2 approaches considered. Combined use of explosive charges and small earthquakes (microseisms) in seismic observations may significantly extend the scope of both methods and impart to them the detail of DSS and the depth of seismological (microseismis) measurements. Data can also be secured from nuclear detonations. Has 27 references.

R203148 67A

Kosminskaya, I P and Galkin, I N

THE SIGNALS RECORDED IN DEEP SEISMIC SOUNDING

Phys Solid Earth, No 10, pp 627-633, Oct 1967. 7 p, 2 fig, 2 tab, 27 ref

DESCRIPTORS-/ *seismic investigations/ *seismic waves/ *seismology/ earthquakes/ explosions/ detonation/ *geophysics/ geophones/ soundings/ longitudinal waves/ explorations/ subsurface investigations/ bibliographies/ foreign research

IDENTIFIERS-/ seismic tests/ amplitude/ *wave propagation/ USSR

R203233 68A ANALYSIS OF STRESSES CAUSING LAND SUBSIDENCE
Land subsidence in areas of intensive groundwater withdrawal is attributed to compaction of deposits caused by increased loading stresses. Record subsidence has been produced in the San Joaquin Valley, California, where accelerated pumping of groundwater for irrigation with consequent large water-level decline has resulted in as much as 26 ft of settlement since 1930. As demonstrated, subsidence is related directly to effective-stress changes computed from water-level data, both unconfined (water table) and confined (artesian). If porosity is 40%, 1-foot water-table rise would cause 0.4-foot increase in effective stress whereas 1-foot artesian head decline would cause 1-foot increase in effective stress. Effective stresses are changed in 2 principal ways: (1) Water-table fluctuations change the buoyant support of sand grains, and (2) a change of the water table or piezometric head, or both, may induce hydraulic gradients and seepage stresses in the deposits. These stress changes are additive in their effect, and together cause compaction.

R203233 68A

Lofgren, Ben E

ANALYSIS OF STRESSES CAUSING LAND SUBSIDENCE

Geol Surv Prof Pap 600-B, pp B219-B225, 1968. 7 p, 4 fig, 5 ref

Geological Survey, Sacramento, Calif

DESCRIPTORS--/ *land subsidence/ compaction/ aquifers/ water table/ effective stress/ artesian wells/ aquicludes/ seepage/ porosity/ *water level fluctuations/ California/ confined water/ hydrostatic pressure/ hydraulic gradient/ irrigation effects/ hydrogeology/ *irrigation wells/ aquitards/ pumping
IDENTIFIERS--/ piezometric head/ San Joaquin Valley, Calif

R203270 67A POROSITY AND PERMEABILITY OF CURDSVILLE LIMESTONE
Factors controlling porosity and permeability of the Curdsville Limestone Member of the Lexington Limestone of Middle Odovician Age in the Blue Grass Region, Ky are geological. Microstratigraphic analysis had led to division of the lower Lexington Limestone, consisting principally of the Curdsville Member into 3 beds which may be subdivided into zones made of several lithologic types and subtypes. Lower, middle, and upper bed characteristics are helpful in determining regional depositional history. Paleogeography of Curdsville time has been determined by delineation of 2 local facies: (1) a carbonate bank--shoal area facies, and (2) a shelf--channel area facies. Ground waters of meteoric origin have created sink holes, solution valleys, and caverns through solution enlargement of fractures comprising an extensive intersecting joint system. Detailed examination of the Bryantsville Quadrangel on the Jessamine Dome Shoal Area indicates fracture traces such as sink hole, solution valley, and stream channel alignments are controlled mainly by nearly vertical joints in the Curdsville and underlying Tyrone Limestones. High frequency and intersection of joint fractures may indicate presence of permeable limestone aquifers at shallow depth. The hypothesis can be tested by drilling several wells.

R203270 67A

MacQuown, William C, Jr

FACTORS CONTROLLING POROSITY AND PERMEABILITY IN THE CURDSVILLE MEMBER OF THE LEXINGTON LIMESTONE

Res Rep 7, Univ Kentucky, 1967. 80 p, 29 fig, 7 tab, 13 ref, 5 append

University of Kentucky, Lexington

DESCRIPTORS--/ porosity/ permeability/ aquifers/ water yield/ springs/ wells/ faults (geology)/ limestones/ groundwater movement/ subsurface waters/ rock properties/ spring waters/ fractures (geology)/ carbonate rocks/ joints (geology)/ Karst/ sinks/ Kentucky

IDENTIFIERS--/ Blue Grass Region, Ky

R203037X68A WATER-HAMMER CONTROL IN PUMP SYSTEMS
Charts are presented for use in designing valve-closure programs to minimize water-hammer effects caused by power failure in centrifugal pump systems. The valve-closure program consists of 2 parts: rapid closure to a specified opening at the time of flow reversal, followed by linear motion to full closure during a period of 5 time intervals following flow reversal. A chart is presented for use in determining the maximum head at the pump that will accompany such a closure program. Other techniques of water-hammer control and their limitations are discussed. The generality of the results impairs their accuracy when applied to particular systems. The results presented are useful for designing a valve-closure program as a starting point in a graphical or numerical analysis. However, an accurate prediction of the expected overpressure must be obtained from an analysis of the system using the actual valve and, if possible, pump characteristics.

R203037X68A

Kinno, Hitoshi

WATER-HAMMER CONTROL IN CENTRIFUGAL PUMP SYSTEMS

Proc Amer Soc Civil Eng, J Hydraul Div, Vol 94, No HY3, pp 619-639, May 1968. 21 p, 10 fig, 2 tab, 8 ref, 2 append

Tokushima University, Tokushimashi, Japan

DESCRIPTORS-/ *water hammer/ *centrifugal pumps/ *hydraulic gates and valves/ *pumps/ failure (power)/ hydraulic transients/ surges/ flow/ pressures/ foreign design practices/ graphical analysis/ *control systems/ *control

IDENTIFIERS-/ *valve vibration/ Japan/ flow characteristics/ water column separation

R203038X68A FLOW IN BUTTERFLY AND SPHERICAL VALVES
Discharge coefficients of butterfly and spherical valves were obtained from tests of 10-in.-dia models. Four lenticular-shaped butterfly valve discs were tested, and in one test the valve disc was offset in relation to the shaft centerline. Four spherical valve rotors were tested. The data can be used to predict the flow and torque for a given set of conditions as illustrated in numerical examples. In testing spherical valve models, hydrodynamic force on the valve was measured. The data can be used to size the trunnions of such valves. The tests were conducted with air as working fluid, and results can be applied to flow of liquids provided cavitation does not occur.

R203038X68A

Guins, Vsevolod G

FLOW CHARACTERISTICS OF BUTTERFLY AND SPHERICAL VALVES

Proc Amer Soc Civil Eng, J Hydraul Div, Vol 94, No HY3, pp 675-690, May 1968. 16 p, 20 fig, 7 ref, 2 append

Westinghouse Electric Corp, Sunnyvale, Calif

DESCRIPTORS--/ *butterfly valves/ *discharge coefficients/ torque/ test procedures/ hydraulics/ cavitation/ characteristics/ *flow/ velocity/ head losses/ test facilities/ pressure conduits/ fluid flow/ *hydraulic gates and valves

IDENTIFIERS--/ *spherical valves/ hydraulic design

R203039X68A FALL VELOCITY OF IRREGULAR SHAPED GRAINS

Determination of free-fall velocity of irregularly shaped particles in viscous fluids is presented. Mathematical expressions for irregularly shaped particles such as naturally worn sediment particles are not obtained easily and do not include pertinent particle measurements of surface area and volume in the shape factor. A shape factor is proposed correlating Reynolds number with the drag coefficient to describe the motion of irregular shapes. This shape parameter results in a useful Reynolds number-drag coefficient relation. Analysis data were collected from tests of natural gravel-size particles of various shapes and sizes, supplemented by larger regular geometric shapes. The basic motions of a particle in free-fall are classified and analyzed considering causes such as flow separation and vortex formation.

R203039X68A

Alger, George R and Simons, Daryl B

FALL VELOCITY OF IRREGULAR SHAPED PARTICLES

Proc Amer Soc Civil Eng, J Hydraul Div, Vol 94, No HY3, pp 721-737, May 1968. 17 p, 11 fig, 4 tab, 6 ref, 2 append

Michigan Technological University, Houghton; Colorado State University, Fort Collins

DESCRIPTORS-- / *sedimentation/ sediments/ *free fall/ drag/ fluid flow/ fluid mechanics/ Reynolds number/ viscosity/ shapes/ *particle shapes/ particle size/ particles/ *grain shapes/ grain sizes/ vortices/ motion/ hydraulics/ circulation/ liquids/ fluids/ gravels/ velocity/ settling velocity
IDENTIFIERS--/ separation/ surface area/ *shape factor

R203042 68A TRANSDUCER MEASURES OPEN CHANNEL FLOW

Laboratory studies of open channels, especially scale models of rivers and estuaries, require determination of water levels and magnitude and direction of current. The instrument described in this paper has been designed for remote measurement of simultaneous values of water level, current velocity, and current direction. The drag and buoyancy forces on a vertical cylinder are transferred to 3 springs with a full strain gage bridge mounted on each. Simple relationships exist between the 3 bridge outputs and the 3 variables required, enabling a suitable calibration to be made. The application to an estuary model is described and future developments are mentioned. The instrument is capable of measuring speeds within the range of 2 to 10 in./sec (5 to 25 cm/s) with an accuracy of plus or minus 10%, while directions are given to plus or minus 5 deg and water surface levels to plus or minus 1/20 in. (plus or minus 1 mm).

R203042 68A

Townson, J M

A TRANSDUCER FOR OPEN CHANNEL FLOW

J Hydraul Res, Vol 6, No 1, pp 45-68, 1968. 24 p, 13 fig, 2 plate, 5 ref

University of Aberdeen, Great Britain

DESCRIPTORS--/ instrumentation/ *water measurement/ velocity/ water currents/ circuits/ *transducers/ calibrations/ *electronic equipment/ drag/ computers/ *strain gages/ damping/ current meters/ models/ open channel flow/ hydraulics/ laboratory equipment/ laboratory tests

IDENTIFIERS-- / bridges (electric)/ accuracy/ foreign research/ Great Britain

R203046X68A HYDRAULIC DESIGN OF LARGE SIPHONS
Siphon structures will be built at the end of several pumping plant discharge lines on the California Aqueduct. These structures terminate below the water surface of the receiving canal and are designed to prevent backflow when the main pumps are not operating. Parameters considered in the hydraulic design of these siphons include: (1) upslope, (2) downslope, (3) bend radius, (4) crest radius and elevation, (5) expanding transition, and (6) minimum tailwater. Additional problems associated with siphons are air accumulation and removal, particularly in the crown. As accumulation rates are difficult to estimate, a minimum clearing velocity is suggested for making this determination.

R203046X68A

Johnson, William K

HYDRAULIC DESIGN OF LARGE SIPHONS

Proc, Western Water Power Symp, pp B-119-B-124, Apr 1968. 6 p, 1 fig, 2 tab, 13 ref

PMT Associates, Inc, Sacramento, Calif

DESCRIPTORS--/ *hydraulic structures/ hydraulic jumps/ slopes/ losses/ *siphons/ transition zones/ transitions (structures)/ friction/ energy losses/ bubbles/ vibrations/ vacuum/ stilling basins/ pumping plants/ air/ operation and maintenance/ energy dissipation

IDENTIFIERS-- / *hydraulic design/ California aqueduct/ California/ hydraulic properties

R203050X68A TEHACHAPI PUMPING PLANT INTAKE STRUCTURES
The Tehachapi Pumping Plant will provide the major lift of water carried by the California Aqueduct from Northern California over the Tehachapi Mountains to Southern California. The 14 pumps will have design discharge of 4,100 cfs at approximately 1,940 ft head. Detailed hydraulic model studies of several alternative designs were performed to select an adequate configuration for the pumping plant intake area. Investigations were conducted on the effects of various pump manifold arrangements on energy losses. A dimensionless loss coefficient was used to establish the energy balance for junction systems with multiple-flow input elements. Studies performed for selection of the intake transition and manifold configurations are discussed. Other investigations are being conducted to determine optimum combinations of pumping units for minimum overall energy losses and assessment of the action of pressure fluctuations in creating fluttering conditions at manifold junctions.

R203050X68A

Amorocho, J; DeVries, J J; Curry, W

HYDRAULIC STUDIES OF THE TEHACHAPI PUMPING PLANT INTAKE CHANNEL AND MANIFOLD

Proc, Western Water Power Symp, pp B-19-B-34, Apr 1968. 16 p, 11 fig, 1 tab, 5 ref

University of California, Davis; California State Department of Water Resources, Sacramento

DESCRIPTORS--/ hydraulic models/ hydraulics/ *pumps/ energy losses/ model tests/ *intake structures/ pumping plants/ discharges/ vortices/ *pump intakes/ turbulent flow/ vibrations/ efficiencies/ resonance/ Reynolds number/ safety/ transitions (structures)/ economies

IDENTIFIERS-/ *manifolds/ Tehachapi Pump Plant, Calif/ hydraulic design/ California Aqueduct/ *splitters/ California State Water Proj/ California

R203064 68A THERMAL METHODS OF FLOW MEASUREMENT
The article reviews the principles of velocity and mass-flow measurement by heat transfer methods and the difficulties encountered in applying these principles. The review is not an assessment of different types of currently available commercial apparatus. Heat loss from a sensing element and use of heat as a tracer are discussed. Measurable flow quantities include: (1) local mean velocity, (2) mass flow, (3) surface shear stress, and (4) velocity fluctuations. Heat loss characteristics of heated-element anemometers and effects of orientation, ambient temperature, and contamination are reviewed. A bibliography is included listing 62 references to literature surveys, recent research papers, and key papers describing the basic principles.

R203064 68A

Bradshaw, P

THERMAL METHODS OF FLOW MEASUREMENT

J Sci Instrum, Ser 2, Vol 1, pp 504-509, May 1968. 6 p, 62 ref

National Physical Laboratory, London, Great Britain

DESCRIPTORS--/ flow/ *fluid flow/ fluid mechanics/ hydraulics/ gases/ bibliographies/ liquids/ fluids/ *hot film anemometers/ thermocouples/ *hot wire anemometers/ *anemometers/ turbulence/ *turbulent flow/ pitot tubes/ thermistors/ thermal conductivity/ contamination/ heat transfer/ measuring instruments/ calibrations/ *discharge measurement/ flow meters
IDENTIFIERS--/ *flow measurement/ rotameter

R203077 68A PRESSURE PULSATIONS IN POWERPLANTS
A hydraulic model of the Krasnoiarsk hydroelectric power station was studied to determine effects of operating a unit at heads lower than rated value. Operations will begin before the reservoir is completely filled to produce additional electric energy. The hydraulic assembly unit is modeled according to Froude with a 1:30 scale. A general diagram of the model is given. The model was studied with rpm ranging from 10-15% lower than optimum efficiency speed to runaway speeds. The study verified that pulsations behind the rotor mainly depend on rpm of the turbine and the results agree with well-known empirical formulas. Pressure pulsation amplitudes in the penstocks were 4 to 5 times smaller than corresponding amplitudes in the rotor chamber. Other pulsations were observed at rotation frequency and at higher frequencies. These pulsations reached their greatest range at maximum discharges and at starting rpms.

R203077 68A

Grigor'ev, V I and Tananaev, A V

ON THE STUDY OF PRESSURE PULSATIONS IN THE FLOW CHANNEL OF THE KRASNOIARSK HYDROELECTRIC POWER STATION HYDRAULIC ASSEMBLY UNIT MODEL

Leningrad Politekh Inst, No 274, pp 7-11, 1966. Transl from Russ, Joint Publ Res Serv Transl 739, June 1968. 7 p, 4 fig, 1 ref

DESCRIPTORS--/ pressure sensors/ pressures/ pressure measuring equip/ *hydroelectric powerplants/ hydraulic transients/ hydraulics/ models/ model tests/ turbines/ penstocks/ *hydraulic models/ surges/ hydraulic machinery/ water hammer/ rotating components/ *pulsating flow

IDENTIFIERS--/ Krasnoiarsk Powerplant USSR/ foreign research/ hydraulic design/ hydraulic pressure

R203098X68A HYDRAULIC TRANSIENTS IN PUMPING PLANTS

Computational procedures for analyzing hydraulic transients in pump discharge lines with electric motor-driven pumps have been known for many years. Although the mechanics of computing hydraulic transients in pump discharge lines have advanced rapidly, several unusual troublesome aspects exist. This paper has a threefold purpose in bringing some of these aspects to the reader's attention: (1) practical and unusual aspects of hydraulic transients in pumping plants are discussed; (2) attention is given to available water-hammer solutions in engineering literature providing a ready solution of the hydraulic transients in pumping plants for many water-hammer control devices; and (3) observed and computed transients in pumping installations with various types of pressure control devices are discussed. Many water-hammer control devices for pumping plants are available, and a choice of the most suitable device can be narrowed to a few practical alternatives. Prior knowledge of available water-hammer solutions for these devices will reduce computational work necessary to determine critical hydraulic transient effects.

R203098X68A

Parmakian, John

UNUSUAL ASPECTS OF HYDRAULIC TRANSIENTS IN PUMPING PLANTS

J Boston Soc Civil Eng, Vol 55, No 1, pp 30-47, Jan 1968. 18 p, 10 ref

DESCRIPTORS--/ *hydraulic transients/ *water hammer/ *pumping plants/ fluid flow/ velocity/ pressures/ control/ pipelines/ failure (power)/ wave velocity/ surge tanks/ electric power failures/ check valves/ air chambers/ hydraulics/ kinetic energy/ analysis/ hydraulic machinery/ specific speed
IDENTIFIERS--/ *discharge lines/ water column separation/ hydraulic design

R203101 68A TURBINE INLET FLOW RATE AND PRESSURE DROP

Regular supervision of the operating parameters of hydrogenerators and rational management in operating a powerplant will increase annual production 8 to 10%. With output N, head H, and flow rate Q known for each operating condition of a unit, the degree of utilization of the turbine output capacity can be established and compared with one attainable under given hydraulic conditions. With H, Q, and N known, appropriate turbine control is possible, and water consumption per unit of power produced may be minimized. Operationally, checking the energy characteristics of hydraulic turbines after overhaul is important. Knowledge of H, Q, and N is indispensible for acceptance tests and is the basis for assessing the overhaul effect. Measuring output N and head h is simple; however, measuring flow rate Q is not easily accomplished. Several methods for continuously measuring flow rate and the accuracy obtained are discussed. A basic interrelation exists between flow rate Q and pressure drop delta h in the turbine spiral case. This paper reviews problems in determining Q by measuring the pressure drop in the spiral case. Has 33 references.

R203101 68A

Steller, Kazimierz

ON THE INTERRELATION BETWEEN FLOW RATE IN A HYDRAULIC TURBINE AND PRESSURE DROP IN THE INLET SCROLL OF A CIRCULAR CROSS SECTION

Pr Inst Masz Przeplyw, No 25, pp 31-63, 1965. Transl from Pol, Tech Transl 67-56059, 1968. 30 p, 14 fig, 2 tab, 33 ref

DESCRIPTORS--/ *hydraulic turbines/ *spiral cases/ hydraulics/ errors/ *discharge measurement/ flow control/ hydroelectric powerplants/ fluid flow/ experimental data/ bibliographies/ acceptance tests/ measurement/ hydraulic machinery/ investigations/ research and development/ water measurement/ power O&M/ *turbines/ calculations
IDENTIFIERS--/ foreign research/ Poland/ *Winter-Kennedy method/ *accuracy

R203238X68A RELATION OF ALLUVIAL CHANNEL RESISTANCE TO BED FORM
Existing data from flume tests over ripple and dune beds are used to study the relation of flow to shear velocity. It is concluded that resistance to flow is related to the stages of development of the ripples or dunes, resistance being greatest at their maximum stages of development. For ripples, the maximum stage of development, for bed material of a given size, occurs at the same shear velocity, irrespective of depth. For dunes, the maximum development occurs at the same value of average velocity/shear velocity and is approximately independent of depth. However, plots of flume data show that, for greater depths, maximum resistance occurs at greater shear velocities, hence at greater average velocities. Application of the results to data from 3 West Pakistan canals show similar flow characteristics, but only over a small part of the dune where range bed resistance is less than maximum. It is suggested that more extensive observations should be made on the dimensions of ripples and dunes and their solution to flow conditions.

R203238X68A

Smith, Kenneth V H

ALLUVIAL CHANNEL RESISTANCE RELATED TO BED FORM

Proc Amer Soc Civ Eng, J of Hydraul, Vol 94, No HY1, Pap 5720, pp 59-69, Jan 1968. 11 p, 8 fig, 1 append

Southampton University, Great Britain

DESCRIPTORS--/ *hydraulics/ flumes/ laboratory tests/ fluid friction/ *flow resistance/ canals/ *open channel flow/ *streambeds/ velocity/ *alluvial channels/ channel flow/ boundaries (surfaces)/ flow rates/ dunes/ currents (water)/ artificial watercourses/ average flow/ bed load/ roughness (hydraulic)/ sand waves
IDENTIFIERS--/ *bed resistance/ average velocity/ bed ripples/ bed roughness

R203245X68A LAMINAR FLOW IN FINITELY WIDE RECTANGULAR CHANNELS
Experimental investigations in rectangular channels with width-to-depth ratios ranging from 2.74:1 to 100:1 confirm the Boussinesq solution of Poisson's equation for 2-dimensional flow. Velocity distribution measurements indicate that errors associated with surface tension and air friction may be negligible in comparison to channel irregularities and errors in measurement. A side-wall function, F sub BY, is defined as the ratio of average velocity in a finitely wide channel to that in an infinitely wide channel. Introduction of F sub BY into the equations for the friction factor and Reynolds number allows comparison of experimental data corrected to what would occur in an infinitely wide channel. Use of the side-wall function is invalid for flows in which the Reynolds number is greater than 800.

R203245X68A

Woerner, Jack L; Jones, Benjamin A, Jr; Fenzl, Richard N

LAMINAR FLOW IN INFINITELY WIDE RECTANGULAR CHANNELS

Amer Soc Civ Eng, J Hydraul Div, HY3, pp 691-704, May 1968. 14 p, 6 fig, 5 tab, 11 ref, 2 append

Land Authority of Puerto Rico, Santurce; University of Illinois, Urbana; State University of New York, Syracuse
DESCRIPTORS--/ *hydraulics/ *laminar flow/ *open channel flow/ banks/ *velocity/ Reynolds number/ *fluid friction/ roughness (hydraulic)/ channel morphology/ spatial distribution

IDENTIFIERS--/ friction factors/ *velocity distribution/ rectangular channels

R203260 67A DIFFERENCE SOLUTIONS OF THE SHALLOW-WATER EQUATION
The quasi-linear partial differential equations known as the shallow-water equations describe the flow of water in open channels or over sloping planes (overland flow). Because no analytic solution exists for these equations, finite-difference methods must be used to obtain solutions. Formulation of finite-difference schemes involves consideration of the convergence of the finite-difference solutions to the true solution of the equation. A theoretical examination of the approximation of several difference operators, both implicit and explicit, is presented and the stability of these schemes is examined empirically for flow over a plane with critical depth downstream boundary condition and a zero inflow upstream boundary condition. A finite-difference scheme based on the method of characteristics was found to be satisfactory in many cases. Explicit methods were found to be not suitable for this problem except in some special cases. Has 19 references.

R203260 67A

Liggett, James A and Woolhiser, David A

DIFFERENCE SOLUTIONS OF THE SHALLOW-WATER EQUATION

Tech Rep 6, Cornell Univ, Aug 1967. 33 p, 14 fig, 1 tab, 19 ref, append

Cornell University, Ithaca, N Y

DESCRIPTORS--/ *computers/ *engineering mechanics/ finite-differences/ hydraulics/ *open channel flow/ flow/ *fluid flow/ shallow water/ *overland flow

IDENTIFIERS-/ shallow-water equation

R203275 68A TAINTER GATES AS FLOW MEASURING DEVICES
This is a Final Report on an intensive study of the feasibility of using Tainter gates as flow measuring devices. Effective use, control, and management of water resources usually requires both flow-control devices and flow measurements. Hydrologic studies on agricultural watersheds involve flows through drainage channels. Basic information on methods of flow control and measurement of flow quantities over and through control structures is of utmost economic importance in design and maintenance of stable channels in erodible soils. Soil and water conservation activities in the Southern Florida Flatwoods, have utilized Tainter gates for the purpose of stream flow control A study of existing control structures was coupled with hydraulic model studies to enhance design of Tainter gates, investigate use of such gates as flow measuring devices, adapt remote sensing devices for recording pertinent field data, and develop a computer program to translate periodic recordings into discharge rates. Hydraulic models of 2 typical installations were built and tested. Model results were in accord with available field measurements. A parametric formulation of pertinent variables was possible and extension of model data to prototype field performance promises to yield quite accurate indirect flow measurements.

R203275 68A

Mayer, Paul G and Olmstead, Bruce R

HYDRAULIC INVESTIGATIONS OF TAINTER GATES AS FLOW MEASURING DEVICES

Water Resour Center Rep, Georgia Inst Technol, Apr 1968. 103 p, 30 fig, 9 tab, 3 append

Georgia Institute of Technology, Atlanta

DESCRIPTORS--/ *radial gates/ *water measurement/ *flow control/ model tests/ *hydraulic models/ analysis/ laboratory tests/ digital recording systems/ laboratory equipment/ recording systems/ hydraulics/ hydraulic gates and valves/ hydraulic gates/ *flow measurement/ investigations/ *discharge measurement
IDENTIFIERS--

R203013X67A SEDIMENT SETTLING & HEAD LOSS IN CONDUITS
This report includes 2 reprints: (1) When investigating the sediment transport problem, important information must include not only the grain size diameter, but the rate of fall of the particles through water. The article informs the reader of important studies on the settling of natural grains. These particles are usually odd-shaped; available knowledge on spherical particles does not always give the most accurate information on natural grains; (2) The object of this investigation was to determine the magnitude of head losses caused by the conveyance of solid-liquid mixtures through circular conduits of variable slopes. The study concentrated on the problem of transporting the mixtures in complete suspension, i.e., so that none of the solid particles settle to the bottom of the pipe. Even within the transport problem of complete suspension, a distinction between homogeneous and heterogeneous suspensions must be made. A homogeneous suspension is possible only if solid distribution is uniform over the pipe cross section. In the case of heterogeneous suspensions, a concentration gradient exists. For homogeneous suspension, head loss equations were developed and experimentally verified. Contains 23 references.

R203013X67A

Graf, Walter and Acaroglu, Ertan R

INVESTIGATION OF TWO-PHASE (LIQUID-SOLID) PROBLEMS

Water Resources Center Tech Rep 2, Cornell Univ, Nov 1967. 24 p, 7 fig, 3 tab, 23 ref

Cornell University, Ithaca, N Y

DESCRIPTORS-/ hydraulics/ suspended sediments/ *slurries/ grain shapes/ grain sizes/ *sediment transport/ *settling velocity/ suspended load/ *sedimentation/ particle shapes/ particle size/ sediment load/ closed conduit flow/ *head losses/ hydraulic conduits/ pipelines/ *hydraulic transportation/ bibliographies
IDENTIFIERS-/ *two-phase flow

R203014 67A PROPERTIES OF STREAM CHANNEL SEDIMENTS
In the arid and semiarid regions of the southwestern United States, a large portion of the natural water recharge is through channel beds and alluvial deposits in river basins. Water transmission in these beds varies with time, location, depth and extent of alluvium, and hydraulic characteristics of flows, sediment loads, and morphology of the channels. An alluvial profile in an ephemeral stream channel was found to have layers with relatively high clay and silt accumulation. Samples from a pit in the channel were subjected to a micromorphological examination using thin sections. Clay and silt were found to have accumulated on sand and gravel particles and around aggregates. In the laboratory, samples of alluvium material were dispersed. The clay and silt fractions were collected, dried, and then mixed again with the washed material. The hydraulic conductivity of the mixed material was 30% less than that for the nondispersed sample. These results are attributed to the orderly arrangement of clay and silt on the surfaces and between the larger sand and gravel particles of the nondispersed samples.

R203014 67A

Qashu, H K and Buol, S W

HYDRAULIC AND MICROMORPHOLOGICAL PROPERTIES OF STREAM CHANNEL SEDIMENTS

Fed Water Pollut Contr Admin Rep, Second Quarter 1967. 5 p, 4 fig, 1 tab, 4 ref

University of Arizona, Tucson; North Carolina State University, Raleigh

DESCRIPTORS-/ infiltration/ permeability/ *sediments/ porous materials/ runoff/ ephemeral streams/ *streambeds/ streamflow/ morphology/ silts/ *alluvial deposits/ sediment transport/ clays/ streams/ hydrology/ hydraulic conductivity/ alluvial streams/ porous media/ Southwest U.S./ Arizona
IDENTIFIERS-

R203027 67A STREAM FLOW RATE EXTREMES
Stream discharge data for the State of Arkansas are analyzed for representative statistical parameters. The statistical distribution most applicable to stream discharge data in Arkansas is the Pearson Type III skew frequency curve. The parameters of the Pearson Type III curve for all available records in Arkansas are included as Appendix A. The paramaters of the logarithmically normal frequency distribution are included as Appendix B for mean daily discharge, minimum daily discharge, and instantaneous minimum daily discharge. The logarithmically normal frequency distribution may be used for the lower discharge rates in lieu of the Pearson Type III distribution except where instances of zero discharge are likely. The following determinations are applicable to the State of Arkansas. There is no correlation between the coefficient of variation and area for minimum daily discharge. There is no correlation between skewness and area. The mean daily discharge rate is 1 cu ft/sec/sq mi. Suggested applications of the parameters in Appendix A are set forth for flood control, pollution control, and water supply.

R203027 67A

Jeffus, Hugh M

QUANTITATIVE ANALYSIS OF STREAM FLOW RATE EXTREMES

Water Resources Res Center Publication 1, Univ of Arkansas, 1967. 310 p, 27 fig, 3 append

University of Arkansas, Fayetteville and US Army Corps of Engineers, Vicksburg, Mississippi

DESCRIPTORS-/ *hydrology/ *streamflow/ runoff/ pollution abatement/ river regulation/ *streamflow records/ statistics/ flood control/ water supplies/ hydrologic data/ discharge measurement/ drainage basins/ *flow rates/ flood peaks/ flood forecasting/ Arkansas/ flow characteristics

IDENTIFIERS--/ Pearson Type III distrib/ flood frequency

R203031 67A STORMFLOW SOURCES IN SMALL WATERSHEDS
The report describes a detailed experimental-numerical investigation designed to isolate the time-spatial distribution of local runoff entering the main channel of a small watershed. The integration of a routing technique and extensive land-phase instrumentation allowed the channel inflows to be identified as flow from seeps, channel precipitation, and ground water. Analysis of a series of storms showed that only a small portion of the watershed contributed flow to the storm hydrograph. The contributing area was found to be a function of the storm duration and intensity and occurred in the form of localized zones of intense contribution. In a given storm the contributing area was found to fluctuate with changes in the rainfall intensity. During periods of low intensity, most of the flow came from channel precipitation and rain falling on the wet areas surrounding a series of seeps. In a period of high intensity flow through the forest litter on the hillsides and a rapid response in the ground water created a larger contributing area. Has 24 references.

R203031 67A

Ragan, Robert M

ROLE OF BASIN PHYSIOGRAPHY ON THE RUNOFF FROM SMALL WATERSHEDS

Water Resources Res Rep 17, Univ Vermont, 1967. 43 p, 18 fig, 24 ref

University of Vermont, Burlington

DESCRIPTORS-/ *runoff/ seepage/ hydrographs/ *geomorphology/ streamflow/ *surface runoff/ *watersheds/ ground water/ rainfall/ storms/ routing/ soil moisture/ discharges/ hydrology/ *drainage basins/ seismographs/ *small watersheds/ watershed management/ rainfall-runoff relationships/ floods/ inflow/ bibliographies
IDENTIFIERS-- / forest seeps

R203034 68A WATER PROJECTS AND WATERSHED TREATMENT
A presumptive approach was used to analyze the effect of land-management-caused alteration of hydrology on output of water conservation projects. Two basic hydrologic reactions to land treatment were assumed: (1) a constant factor flow increase for all months of the year, and (2) a 1/2-month delay in the annual hydrograph. These alterations were applied singly and in combination to a series of computer-generated reservoir inflows; storage-yield relationships were determined by the sequent peak method for altered (treated) and unaltered (virgin) inflows. The differences between yields at various storages were determined by subtraction and attributed to the differences in inflows or alterations. Results indicated that not all flow increases were of value to the project in terms of increased yield. A constant factor increase gained utility with increasing storage. A timing delay had little effect on yield at extremely small and extremely large storages, but had maximum effect at intermediate storages. A combination of flow increases and timing delays affected the yield curve in an approximately additive fashion, combining the 2 separate treatments nearly linearly. Has 75 references.

R203034 68A

Hawkins, Richard Holmes

WATER PROJECTS AND WATERSHED TREATMENT

Pap, Colo State Univ, June 1968. 112 p, 20 fig, 12 tab, 75 ref, append

Colorado State University, Fort Collins

DESCRIPTORS--/ *watersheds/ water yield/ *drainage basins/ runoff/ hydrology/ bibliographies/ reservoirs/ *reservoir yield/ streamflow/ computer programming/ *land management/ water resources/ vegetation

IDENTIFIERS--/ inflow/ *watershed management/ *forest management/ clear-cutting/ forests/ mathematical models/ hydrologic models

R203061 68A RUNOFF IN UNGAGED SEMIARID AREAS
Methods for estimating mean annual runoff in semiarid regions are described for preliminary or reconnaissance evaluations. Limited streamflow data are used to establish runoff-altitude relations by homogeneous regions. Precipitation-altitude relationships can be used to support development of regional runoff-altitude relations where streamflow data are limited. Runoff estimates can be made for ungaged basins within the region from regional values. In generally homogeneous regions, effects of topography, geology, precipitation, and vegetation may result in local variations of regional runoff-altitude relations. Adjustments can be made by measuring runoff during the field study. Miscellaneous measurements of perennial streams in the basin can be used to adjust regional values. Channel geometry measurements can be used to adjust regional values for perennial and ephemeral streams. After runoff-altitude relations are defined, the method of estimating runoff is easy to apply. The method can be applied to a small area having all or part of a drainage basin or to a valley or mountain block having many drainage basins. Application to larger areas will result in more reliable values because areas of inordinately high and low runoff would compensate.

R203061 68A

Moore, Donald O

ESTIMATING MEAN RUNOFF IN UNGAGED SEMIARID AREAS

Bull Int Ass Sci Hydrol, pp 29-39, Feb 1968. 11 p, 7 fig, 4 tab, 2 ref

Geological Survey, Carson City, Nev

DESCRIPTORS--/ *runoff forecasting/ *runoff/ *surface runoff/ *semiarid land/ watersheds/ drainage basins/ hydrometeorological station/ stream gages/ water measurement/ streamflow/ streamflow records/ geomorphology/ discharge measurement/ rainfall/ atmospheric precipitation/ estimating

IDENTIFIERS--/ altitude/ gaging stations/ *runoff-altitude relations/ Nevada

R203070 68A TRACER MEASUREMENT OF STREAMFLOW
This investigation covers several methods of streamflow gaging in streams of 10-250 cusecs using radioactive isotopes and involving withdrawal of samples from streams for in situ measurement. The total counts method was favored because of its ability to sample large volumes, giving reliable results at short sampling distances. For flows of 5000 cusecs and above, the total counts method offers the highest detection sensitivity but requires excessively large tracer amounts with increased health hazards and additional expense. Thus, the total counts method applies to flows up to 5000 cusecs. The method is extended to conditions of noninfinite geometry using a probe in the stream. The extended method allows in situ gaging in streams as shallow as 2 ft. An empirical method for predicting tracer passage times from tracer arrival times is based on a series of measurements of tracer passage in rivers at low flow. The merits of colloidal Gold 198 and Chromium 51 EDTA as tracers for riverflow gaging are discussed. Colloidal gold was insignificantly adsorbed over a measuring reach of 3000 ft.

R203070 68A

Ward, P R B and Wurzel, P

THE MEASUREMENT OF RIVERFLOW WITH RADIOACTIVE ISOTOPES WITH PARTICULAR REFERENCE TO THE METHOD AND TIME OF SAMPLING

Bull Int Ass Sci Hydrol, pp 40-48, Feb 1968. 9 p, 2 fig, 1 plate, 2 tab, 7 ref

Agricultural Research Council of Central Africa

DESCRIPTORS--/ *streamflow/ *discharge measurement/ *water measurement/ *radioactive isotopes/ *tracers/ hydrology/ isotopes/ sampling/ rivers/ time/ measuring instruments/ field tests/ streams/ reaches (distance)/ mixing/ counting method

IDENTIFIERS--/ gold isotopes/ chromium isotopes/ total count method/ Africa/ foreign research/ shallow flow/ travel time

R203089X68A DYE TRACERS COLLECT HYDROLOGIC DATA
Dye tracers were used in Oregon in collecting hydrologic data on 2350 mi of stream channels in the Long Tom, Umpqua, Willamette, and John Day River basins, and in the Carmen-Smith power tunnel. These investigations demonstrated the usefulness of dye tracers for determining: (1) estimates of traveltimes and travel rates of water, (2) discharge where standard measuring methods are not applicable, and (3) dispersion characteristics of streams. The results of time-of-travel studies are presented in simple, concise, and readily interpreted form.

R203089X68A

Harris, D D and Sanderson, R B

USE OF DYE TRACERS TO COLLECT HYDROLOGIC DATA IN OREGON

Water Resour Bull, Vol 4, No 2, pp 51-68, June 1968. 18 p, 11 fig, 3 tab, 9 ref

Geological Survey, Portland, Oreg

DESCRIPTORS--/ *dyes/ *tracers/ *hydrologic data/ *streamflow/ rivers/ velocity/ time/ discharge measurement/ water measurement/ hydrology/ flow/ dispersion/ streams/ fluorescence/ hydrographs/ tunnels

IDENTIFIERS--/ travel time/ Oregon/ fluorometers/ *rhodamine B

R203090X68A RESEARCH METHODS IN LAND-USE HYDROLOGY
Land use changes affecting the hydrological cycle encompass a broad field of agricultural, forestry, and engineering activities. A variety of research methods, ranging from very simple to very complex, have been used to evaluate effects of such changes. Distinguishing the effects of changes in land use from natural variations in quality, quantity, peak rates, and other runoff characteristics is difficult because of the complexity of the hydrological process. Methods of collecting data include use of plots, experimental catchments, barometer watersheds, representative basins, benchmark and vigil networks. Data analysis methods range from simple graphical correlations to multivariate analysis and mathematical catchment models. Current research methods are mainly of an ad hoc nature and the major deficiency is in the study of fundamental physical processes. Has 32 references.

R203090X68A

Boughton, Walter C

RESEARCH METHODS IN LAND-USE HYDROLOGY

Water Resour Bull, Vol 4, No 2, pp 34-44, June 1968. 11 p, 32 ref

Lincoln College, Canterbury, New Zealand

DESCRIPTORS--/ hydrology/ research and development/ *land utilization/ *watersheds/ *drainage basins/ *runoff/ *surface runoff/ geomorphology/ statistical analysis/ bibliographies/ water yield/ soil erosion/ land forms/ calibrations/ *methodology/ land preparation/ land resources/ data collection systems/ streamflow
IDENTIFIERS--/ catchments/ hydrologic models/ *demonstration watersheds/ watershed management/ evaluation

R203117 67A RESERVOIR TEMPERATURE AND EVAPORATION
The application of a monolayer to a reservoir water surface to reduce evaporation causes a relative rise in the water temperature over the temperature that would occur without film application. Data were collected from the 600-acre Pactola Reservoir where a monolayer coverage of 73% was maintained over a 98-day period to evaluate specifically this increase in water temperature. Water temperatures increased at the surface and also at greater depths. This increase in temperature has to be accounted for in predicting the reduction in evaporation by monolayers. Values used for the increased temperature predicted from the combined energy-budget-mass-transfer method indicated a decrease of 8 to 14% in values for evaporation reduction as estimated by the simplified Bureau of Reclamation method, which did not account for the rise in temperature. An approach to predicting the increase in reservoir temperature and the reduction in evaporation as applied to 1 reservoir gave values for the temperature increase close to those measured.

R203117 67A

Bartholic, Jon F; Runkles, Jack R; Stenmark, Ernest B

EFFECTS OF A MONOLAYER ON RESERVOIR TEMPERATURE AND EVAPORATION

Water Resour Res, Vol 3, No 1, pp 173-179, 1967. 7 p, 3 fig, 1 tab, 12 ref

U S Army Electronics Command, Fort Huachuca, Ariz and Texas A&M, College Station
DESCRIPTORS--/ evaporation/ *reservoir evaporation/ *monomolecular films/ water management/ evaporation control/ *water temperature

IDENTIFIERS--/ Pactola Reservoir, S Dak/ Pactola Dam, S Dak

R203131X67A DEPOSITION BEHIND LOW DAMS AND BARRIERS
Many upland areas in the western U.S. are being eroded rapidly by overland flow and little opportunity for redeposition of the sediment is afforded by the drainage channels. Attempts have been made to stop further erosion and refill existing gullies by construction of low dams and barriers. Sheep Creek (Utah), Polacca Wash and Zion Dam (Ariz) and Mexican Springs, Tinian and Cornfield Wash (New Mexico) are sites of such efforts. Observations reported here described particle size, distribution of material deposited, volume, extent and slope of deposit and original channel gradient. Particle size to some extent influenced the rate of filling of steep sided gullies. Filling of the channel upstream depends on amount of coarse material moved as bedload. Up to 10% of material in some cases was deposited above spillway level. Low permeable barriers have steeper surface gradients than originally, while low dams have surface gradients less steep than the original.

R203131X67A

Lusby, G C and Hadley, R F

DEPOSITION BEHIND LOW DAMS AND BARRIERS IN THE SOUTH-WESTERN UNITED STATES

J Hydrol (New Zealand), Vol 6, No 2, pp 89-105, 1967. 17 p, 9 fig, 3 tab

Geological Survey, Denver, Colo

DESCRIPTORS--/ *check structures/ *erosion/ sediment transport/ particle size/ sediment control/ reservoir silting/ dams/ silting/ *deposition (sediments)/ gully erosion/ arid lands/ Arizona/ New Mexico/ Southwest U.S./ Great Basin/ Utah/ alluvial channels

IDENTIFIERS--

R203134 67A RUNOFF AND HILLSLOPE EROSION
Measurements of hydrologic and geomorphic processes were possible on a single high intensity convective thunderstorm in Badger Wash Basin, western Colorado on Aug 12, 1964. The 12-acre basin, fenced to exclude livestock, has a reservoir at the lower end that retains all runoff and sediment. The maximum intensity of rainfall for a 10 minute period was 1.98 inches per hour. The total runoff measured in a reservoir was 0.508 inches over the basin and the total precipitation was 0.90 inches when run-off stopped. Erosion pins along 6 hillslope profiles indicated that approximately 0.11 acre-foot was eroded and 0.090 acre-foot was delivered to the lower end of the basin. Where diverse topography was not a complication, erosion pins were considered to be an accurate measure of soil loss.

R203134 67A

Hadley, Richard F and Lusby, Gregg C

RUNOFF AND HILLSLOPE EROSION RESULTING FROM A HIGH-INTENSITY THUNDERSTORM NEAR MACK, WESTERN COLORADO

Water Resour Res, Vol 3, No 1, pp 139-143, 1967. 5 p, 3 fig, 8 ref

Geological Survey, Denver, Colo

DESCRIPTORS-- /rainfall intensity/ storms/ *erosion/ infiltration/ runoff/ convection/ thunderstorms/ cloudbursts/ soil erosion/ slopes Colorado/ *sediment yield/ *storm runoff/ marking techniques/ rainfall-runoff relationships

IDENTIFIERS--

R203140 68A RUNOFF FARMING: I. EXPERIMENTAL LAYOUT
An experiment was established to grow fruit trees, field crops, and pasture plants in a 100 mm winter rainfall desert region of Israel by harvesting surface runoff from small desert watersheds. Two ancient farm systems were restored to study the hydrology of the desert catchments and the water harvesting techniques of the ancient farmers. Restoration included rebuilding runoff-collecting hillside conduits, farm terraces, fences, and the distribution systems. Rations of catchment to cultivated area were 16 to 1 and 25 to 1 respectively. Water stage recorders and weirs were installed to measure the runoff passing onto the farms and rain gages were placed in the farm catchment area. A meteorological station was set up on one of the farms. The loessial farm soils were sandy and silty loams of aeolian or partly redistributed fluviatile origin, 2.5 to 3 meters deep. During 5 years of research agricultural crops have been subjected to extreme drought conditions and heavy floods. Has 21 references.

R203140 68A

Evenari, M; Shanan, L; Tadmor, N H

"RUNOFF FARMING" IN THE DESERT. I. EXPERIMENTAL LAYOUT

Agron J, Vol 60, No 1, pp 29-32, 1968. 4 p, 7 fig, 21 ref

Hebrew University, Jerusalem, Israel

DESCRIPTORS--/ *water spreading/ irrigation systems/ flood routing/ deserts/ arid climates/ weirs/ water harvesting/ *fruit crops/ field crops/ pastures/ watersheds (basins)/ hydrology/ runoff/ irrigation practices

IDENTIFIERS--/ Negev, Israel/ runoff farming/ water recovery

R203153 68A STATISTICAL PROPERTIES OF DUNE PROFILES
Properties of sand waves formed by subcritical, undirectional water currents are investigated by statistical analyses of streambed profile records. Results show that although bed elevation deviates from the postulated normal distribution of sand particles, estimates of many properties of the bed profiles can be derived from simple statistical models. Records of bed elevation y as a function of distance x along the channel, $y=y(x)$, and time at a fixed place, $y=y(t)$, are from 3 lab flumes 8 in., 2 ft, and 8 ft wide and a straight alluvial channel 55 ft wide. Bed material is fine sand in all cases. Analyses show that both types of records, $y(x)$ and $y(t)$, can be represented as stationary Gaussian processes. Statistical properties of all flume data are similar, and no distinguishing characteristics can be attributed to flume size or to whether bed forms are ripples or dunes. Field data, however, reflect influence of large alternate bars not present in the flumes. The problem of predicting properties of interest of bed profiles is not solved, but results of this study suggest several approaches using both refined theoretical models and additional experimental data. Has 33 references.

R203153 68A

Nordin, Carl F, Jr

STATISTICAL PROPERTIES OF DUNE PROFILES

Geol Surv Open-File Rep, May 1968. 137 p, 44 fig, 7 tab, 33 ref, 3 append

Geological Survey, Fort Collins, Colo

DESCRIPTORS--/ sediments/ *statistical methods/ dunes/ bibliographies/ *sediment transport/ streamflow/ streambeds/ flumes/ particle size/ ripple marks/ channel morphology/ shape/ spectroscopy/ *model studies/ width/ slopes/ spectrum analysis

IDENTIFIERS-- / *bed profiles/ sediment bars/ *spectral analysis/

R203155 68A LOW-FLOW ANALYSIS, BETHLEHEM, NEW YORK
The magnitude and frequency of low flows at 8 sites in and near the southern part of the town of Bethlehem, Albany County, New York, are evaluated. The area is one of continued residential and industrial development and includes about 45 sq mi in Coeymans Creek basin and 30 sq mi in Vloman Kill basin. The analysis is based on a series of base-flow measurements made during the summer and fall of 1966 and the summer of 1967. The low-flow frequency characteristics were determined by correlating the measurements with contemporaneous flows at 2 or more nearby complete-record stations where frequency characteristics have been defined. The correlations produced estimates of the annual minimum 7-day flow to be expected 1 yr out of 2 and 1 yr out of 10. Low-flows are affected to some extent by upstream impoundment and diversions or by discharge into the streams of sewage effluent and backwash water from the Albany filtration plant. Discharge measurements made since 1952 at 18 sites in the 2 basins are tabulated.

R203155 68A

Hunt, Oliver P and Beall, Robert M

A PRELIMINARY ANALYSIS OF LOW FLOWS AT SELECTED SITES IN THE SOUTHERN PART OF THE TOWN OF BETHLEHEM, NEW YORK

N Y Water Resour Comm Rep of Invest RI-1, 1968. 10 p, 2 fig, 3 ref, append

Geological Survey, Bethlehem, N Y

DESCRIPTORS--/ *streamflow/ *base flow/ frequency analysis/ flow rates/ *flow characteristics/ surface waters/ discharge (water)/ *low flow/ streams/ discharge measurement/ New York/ hydrologic data/ stream gages/ alteration of flow

IDENTIFIERS--/ *low-flow frequency/ frequency characteristics/ Hudson River basin/ Bethlehem, N Y/ correlation/ Hudson River

R203156 68A AN INVESTIGATION OF FLOODS IN HAWAII
Annual peak stages and discharges for the period of record to June 30, 1967, are tabulated for 167 stations in Hawaii. The data are arranged on a fiscal-yr basis. Peak discharge measurements from 1961-67 at 56 miscellaneous-measurement sites are given. Tabulation includes data for 125 stations in operation during 1967 fiscal yr. For 1967, flooding was greatest during November and May. Major flood events during the yr were the following: July 25 in the Hilo area of Hawaii, October 10-12 and November 4-6 on Oahu, January 11 on Hawaii, March 24 on Maui, and May 20-21 on Kauai.

R203156 68A

Hoffard, S H and Fowler, K H

AN INVESTIGATION OF FLOODS IN HAWAII THROUGH JUNE 30, 1967.

Geol Surv Water Resour Div, Hawaii, Basic Data Release Progr Rep 10, May 1968. 167 p, 5 fig, 1 tab

Hawaii State Department, Honolulu

DESCRIPTORS--/ *floods/ flood damage/ flow measurement/ gaging stations/ streamflow/ *discharge (water)/ *peak discharge/ flash floods/ channel flow/ *discharge measurement/ Hawaii/ surface waters/ *stage-discharge relations/ river flow/ hydrologic data/ runoff/ flood peaks

IDENTIFIERS--/ *flood stages/ annual peak stage/ peak runoff/ annual floods/ crest-stage gage/ flow measurement

R203157 68A HYDROGEOLOGY, POTOWOMUT-WICKFORD AREA, RHODE ISLAND
Mathematical-model evaluation of the sand and gravel aquifers indicates that during exceptionally dry years they can sustain pumping rates 8 mgd (2 times present rate) in Potowomut River basin, 3.6 mgd (3 times present rate) in Annaquatucket River basin, and 1.3 mgd (13 times present rate) in Pettaquamscutt River basin. An unused aquifer in the Potowomut basin could supply 5 mgd for 100 days with careful management. Sustained pumping at these rates would dry the Hunt and Potowomut Rivers for as much as 160 days and might result in saline-water intrusion in the Pettaquamscutt basin. Hydrologic budgets show annual recharge was 15 in., and groundwater evapotranspiration loss, 3 1/2 in. in Potowomut basin; recharge was 18 in., and ground-water evapotranspiration, about 2 in. in Annaquatucket basin. About 1/2 the runoff in the 2 basins is groundwater discharge. Groundwater is of good quality locally except for excessive iron or manganese. Dissolved-solids content is less than 70 ppm. Variations in coefficient of transmissivity, ranging from 10,000 to 300,000 gpd/ft, are shown on a 1:24,000 scale map. Maps also show saturated thickness, extent of aquifers, and water-table contours. Graphs show components of drawdown in a pumped well and method of computing drawdown. Has 42 references.

R203157 68A

Rosenshein, J S; Gonthier, Joseph B; Allen, William B

HYDROLOGIC CHARACTERISTICS AND SUSTAINED YIELD OF PRINCIPAL GROUND-WATER UNITS, POTOWOMUT-WICKFORD AREA, RHODE ISLAND

Geol Surv Water-Supply Pap 1775, 1968. 38 p, 8 fig, 5 plate, 10 tab, 42 ref

Geological Survey and Rhode Island Water Resources Coordinating Board, Kingston

DESCRIPTORS--/ *hydrograph analysis/ transmissivity/ hydrologic budget/ groundwater recharge/ *aquifers/ *hydrologic properties/ bibliographies/ Rhode Island/ *mathematical models/ permeability/ *groundwater barriers/ streamflow/ discharge (water)/ chemical analysis/ withdrawal/ base flow/ *groundwater/ water quality/ pumping/ infiltration/ evapotranspiration
IDENTIFIERS--/ induced infiltration/ *image-well analysis/ *groundwater potential/ aquifer model/ aquifer characteristics/ *sustained yield

R203209X67A SPRAYED ASPHALT PAVEMENTS FOR WATER HARVESTING
Sprayed asphalt pavement as a low-cost method of water harvesting, was investigated under varying conditions in Ariz. Soils ranging from clay loams to porous cinders were utilized and sprayed with asphalts of varying composition. Specifications of both are given. Pavements first soaked with an asphalt compound to form a strong but porous surface and recoated with a second sealing asphalt compound were in excellent condition 1.5 to 3 years later. They provided essentially 100% runoff of precipitation. The penetration of asphalt into soil and the bonding of soil particles is a function of the chemical compositions of asphalt and of soil, soil structure and soil moisture content. Penetration and bonding cannot be predicted but can be determined by properly conducted laboratory tests. 1100 sq yd pavements have been constructed for approximately 73¢ per sq yd with maintenance costs of 10 to 17¢ per sq yd. Asphalt oxidation products which color runoff water prevent domestic use of this water currently. A satisfactory method for their removal will be necessary before this can be recommended.

R203209X67A

Myers, Lloyd E; Frasier, Gary W; Griggs, John R

SPRAYED ASPHALT PAVEMENTS FOR WATER HARVESTING

Amer Soc Civ Eng, J Irrig Drainage Div, Vol 93, No IR3, pp 79-91, Sept 1967. 19 p, 1 fig, 9 tab, 13 ref

United States Water Conservation Laboratory, Phoenix, Ariz

DESCRIPTORS--/ deserts/ asphaltic concrete/ *asphalt/ membranes/ soil stabilization/ bituminous materials/ spraying/ pavements/ *impervious membranes/ surface runoff/ *water harvesting/ bonding/ *soil sealants/ rainfall-runoff relationships/ watersheds (basins)/ paving/ *water yield improvement
IDENTIFIERS--/ *asphalt membranes

R203211 68A THE MEANDERING OF NATURAL STREAMS IN ALLUVIAL MATERIAL
Although there have been numerous publications which might be classified under the general subject of meanders, they have, for the most part, been preoccupied with the origin of meanders, helicoidal flow or the search for a characteristic or standard meander. There seems to be little published information on the analysis of actual velocity patterns, the nature and role of bank caving or anomalies and differences in the geometry of bends. The purpose of this paper is to present a qualitative summary of current knowledge on the meandering of streams in alluvial materials, based upon a review of pertinent literature, data supplied by the Vicksburg and Little Rock Districts, Corps of Engineers, United States Army, and the observation of small-scale meanders on a tilting sand table. It is intended that this paper provide some coverage of the aspects of meandering that have hitherto been neglected.

R203211 68A

Shindala, Adnan and Priest, Melville S

THE MEANDERING OF NATURAL STREAMS IN ALLUVIAL MATERIALS

Water Resour Res Inst Rep, Miss State Univ, June 1968. 21 p, 6 fig, 12 ref

Mississippi State University, State College

DESCRIPTORS--/ *rivers/ erosion/ deposition/ stream erosion/ stream meandering/ river training/ river currents/ *meanders/ sediment distribution/ flow characteristics/ bank stability

IDENTIFIERS--/ river bends/ helicoidal flow

R203213 68A DROUGHT FREQUENCY, INTENSITY, AND DURATION
Meteorological and hydrological data in Raritan River basin, New Jersey, is correlated. Distribution of Palmer Drought Index (PDI) provides basis for designating a characteristic monthly streamflow below which streamflow deficits are measured. Synthetic generation of PDI values is demonstrated and methodology of determination of severity, duration, and frequency of meteorological and hydrological droughts from synthetic data is shown.

R203213 68A

Havens, A V; Snow, W B; Liu, C S; et al

DROUGHT FREQUENCY, INTENSITY, AND DURATION: ITS CORRELATION TO STREAMFLOW AND ITS IMPACT UPON SYNTHETIC HYDROLOGY

Water Resour Res Inst Tech Rep, Rutgers Univ, 1968. 49 p, 10 fig, 7 tab, 9 ref

Rutgers--The State University, New Brunswick, N J

DESCRIPTORS--/ *droughts/ frequency/ *streamflow forecasting/ water yield/ *stochastic processes/ *synthetic hydrology/ duration/ time series analysis/ rainfall-runoff relationships

IDENTIFIERS--/ drought index/ Raritan River Basin, N J

R203214 68A RUNOFF COEFFICIENTS FOR SMALL AREAS
The design flood peak for small drainage structures is usually estimated as the product of a runoff coefficient, a rainfall intensity, and a drainage area. The primary problem encountered in applying the method is selecting an appropriate runoff coefficient. Actually, the coefficient is the product of two components. The first relates peak overland flow rate to peak rainfall intensity. The second relates peak streamflow to peak overland flow. The Stanford Watershed Model was used to develop a set of curves to estimate the peak rate of overland flow from average watershed values of soil depth, soil permeability, overland slope, impervious area, and soil surface exposure. Fifty-yr runoff coefficients for Lexington, Kentucky for 39 natural watersheds varied from 0.354 to 0.610. A second curve was developed for adjusting the coefficient for climatic differences. Multipliers ranged from 1.28 for the North Carolina mountains to 0.71 for Central California. A third curve for adjusting the coefficient for frequency showed multipliers ranging from 0.61 for the mean annual flood to 1.12 for the 1000-year flood. The overland flow runoff coefficient may be estimated as the product of the basic value and the two appropriate adjustment multipliers. Contains 36 references.

R203214 68A

Miller, Carlos Fix

EVALUATION OF RUNOFF COEFFICIENTS FROM SMALL NATURAL DRAINAGE AREAS

Res Rep 14, Univ Ky, 1968. 112 p, 25 fig, 14 tab, 36 ref

University of Kentucky, Lexington

DESCRIPTORS--/ *surface runoff/ infiltration/ slopes/ flood routing/ frequency curves/ drainage/ flow duration curves/ culverts/ vegetation effects/ *rational formula/ runoff coefficient/ peak discharge/ time of concentration/ *overland flow/ *rainfall runoff relationships/ frequency analysis/ soil surfaces/ precipitation excess/ bibliographies
IDENTIFIERS--/ Stanford Watershed Model/ vegetal cover

R203216 68A HYDROGRAPH CHANGES & WATERSHED CONDITIONS
Selection of the economic optimum combination of flood control measures by stage throughout project life and by location within the flood plain requires evaluation of the effects of urban development and channel improvement on the peak, volume, rising time, and shape of the flood hydrograph. Through application of the Stanford Watershed Model to a given watershed before and after an extensive period of urban development and channel improvement, a series of curves were developed for determining each of the effects on flood hydrographs. The end product is a computer program capable of generating flood hydrographs appropriate for any typical watershed surface, drainage area, urban development, and degree of channel improvement. Values are developed and compared between California and Kentucky to obtain some idea as to the effects of geographical and climatic setting on the results. The method of hydrograph generation is applied to an economic analysis of the optimum combination of structural and non-structural flood control measures within South Jefferson County, Kentucky, Has 32 references.

R203216 68A

Dempsey, Clyde R.

THE EFFECTS OF GEOGRAPHICAL AND CLIMATIC SETTING ON THE ECONOMIC ADVANTAGES OF ALTERNATIVE FLOOD CONTROL MEASURES

Res Rep 10, Univ Ky, 1968. 166 p, 26 fig, 45 tab, 32 ref, 5 append

University of Kentucky, Lexington

DESCRIPTORS--/ *hydrographs/ streamflow forecasting/ flood plains/ land use/ project planning/ digital computers/ floodproofing/ *urbanization/ flood plain zoning/ channel improvement/ *non-structural alternatives/ economic justification/ climatic zones/ time lag/ bibliographies

IDENTIFIERS--/ *urban hydrology/ Sacramento, Calif/ Stanford Watershed Model/ Sacramento Valley, Calif/ economic evalution/ Louisville, Ky

R203223 68A THE EFFECTS OF VARYING LAND AND WATER USE
The effects on streamflow regimen of converting an irrigated area to dry land, with concurrent transportation of the water to a municipality located several miles from the original point of use, were studied. A water budget of the city of Laramie, Wyoming was made on a daily basis from May 1, 1965 to September 30, 1967. All inflows to the system were monitored and the outflow to the river observed. The effect of the municipality's water supply system on the streamflow regimen was determined. Both an inflow-outflow study and Blaney-Criddle analysis were made on the use by agriculture. Return flows approximating 20% of diversion should have been evidenced. A comparison of type of use on the streamflow is presented for both the same annual volume of diversion and the same maximum rate of diversion. Has 44 references.

R203223 68A

Rechard, Paul A and Lane, John E

THE EFFECTS OF VARYING LAND AND WATER USE ON STREAMFLOW REGIMEN

Water Resour Ser 10, Univ Wyoming, June 1968. 64 p, 7 fig, 16 tab, 44 ref

University of Wyoming, Laramie

DESCRIPTORS--/ irrigation/ municipal water/ *return flow/ *streamflow/ *water rights/ water utilization/ water measurement/ consumptive use/ hydrologic budget/ hydrologic equation/ *land use/ municipal wastes/ water consumption/ water resources development/ *prior appropriation/ treatment facilities/ Wyoming/ bibliographies
IDENTIFIERS--/ Laramie, Wyo

R203226 68A TANK FOR DEMONSTRATING ALLUVIAL PROCESSES
A narrow, portable sedimentation tank was constructed to demonstrate fluvial processes in a physical geology classroom. The tank consists of 2 pieces of 9 x 48 in. glass mounted 1-3/4 in. apart in an angle-iron frame. The tank had adjustable legs to vary the slope of the bottom and a movable drain to vary the depth of water. A V-shaped feeding tray placed on top of the tank was used to introduce water and sediment into the tank. The glass sides allowed the formation to be viewed in cross-section. This apparatus successfully demonstrated the formation of alluvial fans and deltas with topset and foreset beds. It also was useful in demonstrating headward erosion and movement of turbidity currents down a steep underwater slope.

R203226 68A

Larsen, Frederick D

A TANK FOR DEMONSTRATING ALLUVIAL PROCESSES

J Geol Educ, Vol 16, No 2, pp 53-55, Apr 1968. 3 p, 5 fig, 2 ref

Norwich University, Norfield, Vermont

DESCRIPTORS--/ *geomorphology/ *hydraulic models/ deltas/ sedimentation/ stream erosion/ laboratories/ technology/ *deposition (sediments)/ model studies/ alluvial deposits/ alluvium/ *hydrogeology/ turbidity currents

IDENTIFIERS--/ *headward erosion/ *portable sedimentation tanks

R203232 68A RELATION OF CHANNEL WIDTH TO STREAMBED PERMEABILITY

An analysis of geohydrologic conditions along Big Sandy Creek, east-central Colorado, indicates that the widest part of the 178-mi long channel corresponds with the beginning of stream losses and a decrease in channel width, both of which are related to the streambed permeability. The channel widens downstream in the upper 38 mi with mostly perennial streamflow, and narrows downstream in the lower 140-mi reach where flow is mostly ephemeral. The water table is from 2 to 5 ft below channel bed in the lower reach and the valley alluvium can absorb and transmit the entire flow of the usual short-duration floods. The decrease in channel width is the result of adjustment to long-term downstream decrease in flood discharge. Rate of decrease in width between any 2 sites along the channel affords a basis for estimating average vertical permeability of the streambed between those sites. The estimated values of permeability may be used for computation of water losses from the stream to the valley alluvium.

R203232 68A

Coffin, Donald L

RELATION OF CHANNEL WIDTH TO VERTICAL PERMEABILITY OF STREAMBED, BIG SANDY CREEK, COLORADO

Geol Surv Prof Pap 600-B, pp B215-B218, 1968. 4 p, 2 fig, 1 ref

Geological Survey, Helena, Mont

DESCRIPTORS--/ *streambeds/ permeability/ streamflow/ ephemeral streams/ water table/ channels/ seepage/ *channel morphology/ *influent streams/ regimen/ alluvium/ floods/ perennial streams/ porous media/ underflow/ transmissivity/ discharge (water)/ Colorado/ geologic control/ channel flow/ precipitation (atmospheric)/ *surface-groundwater relationships
IDENTIFIERS--/ vertical permeability

R203237X68A DOUBLE-MASS ANALYSIS ON THE COMPUTER

A method of double-mass analysis on the computer is described. The flow diagram is illustrated, and samples of output are given. The double-mass analysis is used by hydrologists to verify the consistency of precipitation or streamflow records by plotting data from one station against the combined data for surrounding stations. The consistency is verified if a single straight line through the points is reasonable. Computer analysis involves fitting a straight line and a fourth-degree polynomial through the points and comparing the 2 sums of squares of deviations of the points from the fitted curves. If inconsistent, the break point in the record can be determined by the computer which also will compute equations for the straight lines through the points on each side of the break point. The computer method is suggested to save time and minimize data handling, and should be of value to hydrologists who have such facilities available.

R203237X68A

Singh, Rameshwar

DOUBLE-MASS ANALYSIS ON THE COMPUTER

Proc Amer Soc Civ Eng, J Hydraul Div, Vol 94, No HY1, pp 139-142, Jan 1968. 1968. 4 p, 2 fig, 1 tab, 2 ref

San Jose State College, Calif

DESCRIPTORS--/ methodology/ hydraulics/ hydrologic data/ *streamflow/ graphical analysis/ hydrology/ *mass curves/ computer programs/ least squares method/ mathematical studies/ *analytical techniques/ stations/ evaluation/ data collections/ *precipitation (atmospheric)/ statistical methods
IDENTIFIERS--/ *double-mass curves

R203241X68A SEDIMENTATION IN RETARDING BASINS
Negligible amounts of sediment have been deposited in Ohio's 5 Miami Conservancy District retarding basins during 40 yr of operation. Earth dams, 65 ft to 110 ft high, were designed to pass medium and low flows but to retard flood flows. Sedimentation increases as detention time increases and sediments of longer detention have a higher clay content. Trap efficiencies of the basins are in the 10% to 40% range for the few days each yr that they store water. Sedimentation is not a major problem in the dry retarding basins operated for flood control purposes.

R203241X68A

Curtis, Lamont W, Jr

SEDIMENTATION IN RETARDING BASINS

Proc Amer Soc Civ Eng, J Hydraul Div, Vol 94, No HY3, pp 739-744, May 1968. 6 p, 4 tab, 3 ref, append

Havens and Emerson, Consulting Engineers, Cleveland, Ohio

DESCRIPTORS--/ hydraulics/ *sedimentation/ *reservoirs/ particle size/ *flood control/ clays/ dam design/ hydrology/ velocity/ suspended sediments/ *silting/ impoundments/ Ohio/ low flow/ *trap efficiency/ *reservoir silting/ reservoir storage/ floodwater/ suspended load

IDENTIFIERS--/ *retarding basins

R203242X68A EFFECTS OF DENSITY RATIO ON SEDIMENTARY SIMILITUDE
Experimental work reveals that significant similarity may be achieved in certain cases of sedimentary phenomena without satisfaction of equality of density ratio. The equation of motion of particles falling in a vertically oscillating fluid column is made dimensionless by a linear scale which minimizes the effect of density ratio. It is shown that average fall velocity of particles in such circumstances is less than terminal settling velocity in still fluid. By a combination of dimensional analysis and physical reasoning, scale ratios are derived which give better correlation for various density ratios in the experimental case of scour phenomenon here considered than those suggested previously.

R203242X68A

Field, Walter G

EFFECTS OF DENSITY RATIO ON SEDIMENTARY SIMILITUDE

Amer Soc Civ Eng, J Hydraul, Vol 94, No HY 3, Pap 5948, pp 705-719, May 1968. 15 p, 5 fig, 2 tab, 7 ref, 2 append

University of Newcastle, New South Wales, Australia

DESCRIPTORS--/ *dimensional analysis/ hydraulics/ *sedimentation/ flow/ scour/ velocity/ prototype tests/ density/ erosion/ flow/ particle size/ sands/ settling velocity/ *experimental models/ particle shape/ analytical techniques

IDENTIFIERS--/ *sedimentary similitude/ *density ratio

R203247X68A BANKFUL FREQUENCY IN RIVERS
The mean frequency with which streams exceed bankful level is examined using gaging-station data from New South Wales, Australia. The claim that bankful levels are remarkably constant is suspect because reported frequencies range from 1 or 2 yr to 5 yr. Because of possible recent incision of flood plains, 3 channel benches named "high," "middle," and "low" are considered as well as the flood plain. The high bench is not present everywhere and is assumed to be the flood-plain equivalent. Statistical analysis indicates a reasonable probability that the grouped bankful frequencies for the high bench and flood-plain levels represent one frequency distribution. That frequency, based on data from drainage areas ranging from 174 to 220,000 sq mi, is 1.24 to 2.69 yr (in terms of annual maximum series). The middle bench also seems to be associated with a constant bankful frequency ranging from 1.02 to 1.21 yr. The recognition of stream benches is important in identifying the active flood plain or equivalent level and in distinguishing flood plains from terraces. Channels and benches are illustrated by photographs and drawings, and statistical data are given in tables. Has 17 references.

R203247X68A

Woodyer, K D

BANKFUL FREQUENCY IN RIVERS

J Hydrol, Vol 6, No 2, pp 114-142, Apr 1968.- 29 p, 11 fig, 7 tab, 17 ref

Division of Land Research, CSIRO, Canberra, Australia

DESCRIPTORS-/ frequency/ hydraulics/ *streamflow/ flood plains/ banks/ *geomorphology/ streams/ rivers/ cnannels/ hydrology/ surface waters/ frequency analysis/ gaging stations/ *alluvial channels/ river beds/ channel flow/ floods/ natural streams/ foreign research/ terraces (geological)
IDENTIFIERS-/ *flood probability/ stream benches/ annual floods/ Australia

R203254 68A QUALITY CONTROL OF COEFFICIENTS IN SEDIMENT STUDIES
Alinement charts and a simplified procedure are given for quality evaluation and control in sediment studies. Data variations whether by measurement error or natural variation are resolved by a simplified exercise to determine the quality of the mean, and can be computed with simple tabulation and a nomograph. Procedures also are presented for estimating coefficient quality and developing criteria to determine the necessary observations required for the numerator and denominator of a desired ratio. The evaluation of adjustment coeffients commonly used to adjust single-vertical measurements of suspended-sediment concentration by measuring the cross-sectional concentration is illustrated. The method described is less cumbersome than the algebraic method for evaluating a mean or the ratio of 2 means of sediment concentration.

R203254 68A

Guy, Harold P

QUALITY CONTROL OF ADJUSTMENT COEFFICIENTS USED IN SEDIMENT STUDIES

Geol Surv Prof Pap 600-B, pp B165-B168, 1968. 4 p, 2 fig, 5 tab, 1 ref

Geological Survey, Fort Collins, Colo

DESCRIPTORS--/ quality control/ streams/ sampling/ nomographs/ *sediment load/ coefficients/ *sedimentation/ sediments/ sediment distribution/ *statistical methods/ evaluation/ suspended load/ data collections

IDENTIFIERS--/ Snedecor method

R203262 67A WATERSHED HYDRAULICS IN THE LABORATORY
Laboratory facilities are basic ingredients in the understanding of the hydromechanic behavior of natural watersheds. The significant variables which influence time of concentration, time to equilibrium, time to peak, lag time, etc., are readily observable, thus providing an insight into the hydromechanic behavior of watersheds. This paper is devoted to a discussion of the characteristics of the time distribution of runoff (hydrograph) with comments on lag time, time to peak, and other characteristic time responses of watersheds. Various definitions concerning the concept of time of concentration exist in hydrologic literature. The general definition, "the time it takes a drop of water to travel from the uppermost part of the watershed to the outlet," is shown to be in direct contradiction to the definition "the time it takes a watershed to attain maximum discharge when subjected to a constant intensity rainfall." Has 19 references.

R203262 67A

Harbaugh, Terence E

WATERSHED HYDRAULICS IN THE LABORATORY

Pap, 3rd Anmu Amer Water Resour Ass, San Francisco, Calif, Nov 1967. 19 p, 5 fig, 19 ref

University of Missouri, Rolla

DESCRIPTORS--/ hydrologic data/ flood peaks/ *hydraulic models/ flood forecasting/ bibliographies/ *watersheds/ runoff/ surface runoff/ time lag/ hydrology/ rainfall/ rainfall intensity/ rainfall simulators/ time of concentration/ rainfall-runoff relationships/ overland flow

IDENTIFIERS--/ *hydrologic models/ flood hydrology

R203264 68A SUCCESSFUL ICE DUSTING AT FAIRBANKS, ALASKA
The presence of ice jams during spring breakup and the resultant flooding of rivers has always been an interesting aspect of life in Alaska and other northern areas. As the populations of these areas grow, however, the economic cost of permitting these jams and floods can become intolerable. Consequently, methods of jam prevention or elimination are being sought. Much work has been done, particularly by the Corps of Engineers, to develop methods of destroying jams once they have occurred. In many areas these curative measures seem to be the most practical solution. In highly developed areas, however, it may be more feasible to prevent the jam from forming rather than to destroy it following its formation. This paper describes one apparently successful attempt to prevent jamming, and potentially severe flooding, by the use of coal dust and fly ash to increase the absorption of solar radiation and hasten breakup.

R203264 68A

Cook, R Gordon and Wade, Mason D

SUCCESSFUL ICE DUSTING AT FAIRBANKS, ALASKA, 1966

Proc Amer Soc Civ Eng, J Hydraul Div, pp 31-41, Jan 1968. 11 p, 16 fig, 2 ref

University of Alaska, College

DESCRIPTORS--/ ice prevention/ *solar radiation/ flood protection/ freezing/ *dusting/ *ice/ *coal/ ice loads/ *ice jams/ floods/ *coals/ *ice breakup

IDENTIFIERS--/ ice forming/ *Alaska/ ice control/ Chena River, Alaska

R203266 68A FLOW CHARACTERISTICS IN AN OPEN CHANNEL
Application of a method of velocity determination in an open channel using a microscope and camera to record the motion of small particles suspended in water is described. Velocity measurements were made in a series of thin planes orientated parallel to channel bottom for the case of 2-dimensional laminar and turbulent open channel flow. Velocity profiles near the boundary were plotted and boundary shear computed from the rate of shear thus determined. Turbulence intensity was computed and the distribution of particle velocities examined. The method yields boundary shear values to within plus or minus 15% and this uncertainty can be reduced significantly. Maximum error is caused by uncertainty in location of the focal plane and in location of a particle within the focal plane. This difficulty causes greater error in computation of turbulence intensity. The error increases as distance from the boundary decreases. Particle velocity distributions exhibit a positive third moment which is in qualitative agreement with previous measurements. Has 20 references.

R203266 68A

Wenzel, Harry G and Mathews, Michael J

MICROSCOPIC DETERMINATION OF BOUNDARY SHEAR AND SUBLAYER TURBULENCE CHARACTERISTICS IN AN OPEN CHANNEL

Water Resour Center Res Rep 13, Univ Ill, Jan 1968. 78 p, 25 fig, 3 tab, 20 ref

University of Illinois, Urbana

DESCRIPTORS--/ density/ viscosity/ shear stress/ Reynolds number/ data reduction/ boundary shear/ settling velocity/ *open channel flow/ *flow characteristics/ optical instruments/ motion pictures/ microscopy/ two-dimensional/ *turbulent flow/ turbulence/ *laminar flow/ hydraulics/ bibliographies
IDENTIFIERS--

R203269 67A EROSION EFFECT ON INFILTRATION RATES
Various soils in Missouri were studied to determine water infiltration rates and the effect of erosion on infiltration rates. Results showed that the effect of antecedent moisture on the infiltration rate is also dependent on other factors. Factors of major influence are crop cover, degree of aggregation, and bulk density. Results showed effect of antecedent moisture on the infiltration rates was greatest when the soil was bare and well tilled. In clay pan soils, when volume above the clay layer has been filled, infiltration rate is then the rate at which water can percolate the clay layer. Results in some cases seem to contradict results of previous researchers in that they have reported antecedent moisture as a major factor in influencing the infiltration rate. The final infiltration rate is affected only to a minor extent by the antecedent moisture. Bulk density and degree of aggregation can have a large effect on the infiltration rate. These factors change throughout the year with tillage practices, freezing and thawing of the soil and soil moisture. Consequently, infiltration rates change accordingly. The infiltrometer which has been developed is a quick, convenient, and reliable device whereby pertinent data can be obtained. Has 26 references.

R203269 67A

Powell, G M and Beasley, R P

EFFECT OF EROSION ON WATER INFILTRATION RATES

Res Bull 922, Univ Missouri, Apr 1967. 48 p, 23 fig, 5 tab, 26 ref

University of Missouri, Columbia

DESCRIPTORS--/ *soil erosion/ *erosion/ *infiltration/ runoff/ soils/ surface runoff/ grasses/ bibliographies/ cover crops/ soil physical properties/ soil moisture/ soil science/ agriculture/ instrumentation/ measuring instruments/ aggradation/ infiltrometers/ Missouri/ rainfall simulators
IDENTIFIERS--

R203273 68A TIME OF TRAVEL OF WATER, THE GREAT MIAMI RIVER, OHIO
A time-of-travel study, using a soluble dye (Rhodamine BA), was made of the Great Miami River during low streamflow in July and August 1965, to obtain basic information about water movement in the 71.3 mi reach between Dayton and Cleves, Ohio. A slug of dye was injected at the head of a subreach, and its concentration at selected downstream sites was measured with a fluorometer. Traveltimes were 182 and 254 hr for index discharges of 550 and 380 cfs, respectively, at Miamisburg. Peak traveltimes averaged 91% of the centroid traveltimes for the reach. Traveltimes computed by the average-velocity method were less than those for the centroid of the dye cloud. A method of using a straight-line log-log plot of traveltimes versus index discharge to predict traveltimes is stated. The resulting equation, T = 400 x 10 squared x 1/Q to .85 power, is applicable for a discharge range of 300-800 cfs. Data for the two traveltime runs are tabulated and plotted on graphs showing elapsed time versus river miles.

R203273 68A

Bauer, Daniel P

TIME OF TRAVEL OF WATER IN THE GREAT MIAMI RIVER, DAYTON TO CLEVES, OHIO

Geol Surv Circ 546, 1968. 15 p, 8 fig, 6 tab, 4 ref

Geological Survey, Washington, D C

DESCRIPTORS--/ methodology/ dispersion/ streamflow/ *velocity/ *tracers/ stream gages/ streamflow records/ hydrology/ Ohio/ *dye releases/ river forecasting/ *low flow/ *flow rates/ water circulation/ fluorometry/ discharge (water)

IDENTIFIERS--/ fluorometers/ average velocity method/ *travel time

R203280 68A REMOTE SENSING OF DYE TRACER IN HYDROLOGIC STUDIES
Several systems for detection of rhodamine B dye are described as useful in determining the movement and dispersion of soluble contaminants in streams and estuaries. All systems undergo interference from sun reflections ("glitter"), imaging less than other systems since areas of "sun glitter" can be seen and neglected in image analysis. The narrow-band interferometer system, which reduces background effects, is useful for low dye concentrations under minimum "sun glitter." It is the only system applicable to general luminescence. The photographic system requires film analysis by densitometer to obtain concentration values. A photometer or a television scanning system is processed electronically, as time data are taken, to give a read out of vertically integrated amounts of dye. A geometric explanation is given for specular reflection of direct sunlight from water waves. This technique may allow use of a line-depth method under "glitter" conditions.

R203280 68A

Betz, H T

THE REMOTE MEASUREMENT OF RHODAMINE B CONCENTRATION WHEN USED AS FLUORESCENT TRACER IN HYDROLOGIC STUDIES

Tech Lett NASA-101, Jan 1968. 52 p, 6 fig, 8 tab, 6 ref, append

IIT Research Institute, Chicago, Ill

DESCRIPTORS--/ aerial photography/ fluorescence/ hydrologic data/ water quality/ streams/ estuaries/ tracers/ dispersion/ turbidity/ *remote sensing/ absorption/ *dye releases/ *tracking techniques/ wavelengths/ photometry/ waste water (pollution)

IDENTIFIERS--/ *fluorescent tracers/ densitometers/ *rhodamine B/ tracking/ *multispectral scanning

HYDROLOGY

R203283 68A CREST-STAGE GAGING STATIONS, OREGON 1967
The report tabulates stage and discharge data associated with recorded floods at 151 crest-stage stations in Oregon. The stations are distributed in all parts of the state, except the extreme southeastern part. Data are presented for the 1967 water yr; data for earlier yr were tabulated in a previous report. The crest-stage gaging stations are operated to provide information on flood characteristics for small drainage basins.

R203283 68A

Anon

CREST-STAGE GAGING STATIONS IN OREGON

Geol Surv Rep, Jan 1968. 8 p, 1 fig, 6 tab

Geological Survey, Portland, Oreg

DESCRIPTORS--/ streamflow/ hydrologic data/ streams/ gaging stations/ discharge measurement/ flood peaks/ Oregon/ *floods/ *small watersheds/ *stage-discharge relations/ discharge (water)/ *peak discharge

IDENTIFIERS--/ *crest-stage stations/ peak stages

IRRIGATION

R203074X68A HEAD-LOSS TABLES FOR SPRINKLER LATERALS
The choice of pipe diameters for sprinkler irrigation lateral pipe depends on an evaluation of head losses which, generally, are computed only approximately. The current procedure for computing these head losses in sprinkler laterals is reviewed. Head-loss expressions to account for pipe flow and quick and branching-flow couplers are developed. These expressions facilitate computing pressure heads at end sprinklers on a lateral. The required parameters are: (1) diameter of the lateral, (2) number of sprinklers, (3) operating conditions for the selected sprinkler, (4) sprinkler spacings, and (5) tubing lengths. The expressions can be used to prepare tables for selecting proper lateral diameters. Preparation and use of tables for 3-in. horizontal aluminum laterals are demonstrated.

R203074X68A

Benami, Amnon

NEW HEAD-LOSS TABLES FOR SPRINKLER LATERALS

Proc Amer Soc Civil Eng, J Irrig Drain Div, Vol 94, No IR2, pp 185-197, June 1968. 13 p, 2 tab, 9 ref, 2 append

Israel Institute of Technology, Haifa

DESCRIPTORS--/ *head losses/ *sprinkler irrigation/ irrigation systems/ irrigation/ *laterals/ pressure pipes/ couplings/ aluminum/ fluid flow/ pipelines/ rigid tubing/ slopes/ hydraulics/ *design data/ flow/ fluid friction

IDENTIFIERS--/ diameters/ bifurcations

R203095X68A CENTER-PIVOT SPRINKLER IRRIGATION SYSTEM
A self-propelled center-pivot system that will irrigate one-quarter section of land is a recent innovation of sprinkler manufacturers. The effectiveness of this equipment was studied using established guidelines of the ASAE. Mathematical equations are given for application depths and rates, and a method for evaluating the uniformity of application depths is presented. Theoretical solutions for distribution of application depths from a center-pivot sprinkler system are compared with field measurements. Distribution of the application rate radially from the center pivot is shown. The analysis provides the formulation necessary for proper design of a self-propelled center-pivot sprinkler irrigation system.

R203095X68A

Heermann, D F and Hein, P R

PERFORMANCE CHARACTERISTICS OF SELF-PROPELLED CENTER-PIVOT SPRINKLER IRRIGATION SYSTEM

Trans Amer Soc Agr Eng, Vol 2, No 1, pp 11-15, Jan-Feb 1968. 5 p, 8 fig, 3 tab, 4 ref

Colorado State University, Fort Collins

DESCRIPTORS--/ *irrigation systems/ *sprinkler irrigation/ performance tests/ field tests/ distribution systems/ distribution/ irrigation/ automatic control

IDENTIFIERS--/ application techniques/ equations/ formulas/ depth

R203114 67A EFFECTS OF IRRIGATION ON SAFFLOWER YIELD
An experiment was conducted to determine yield responses of safflower to varying amounts of water applied in pre-irrigation and supplemental crop irrigations on Panoche clay loam soil in Fresno county. Fertilization prior to pre-irrigation was uniform. Fifteen pounds of U S 10 safflower variety (per acre) were drilled in two rows on each 40-inch bed spaced 20 inches apart. Individual test plots were 24 ft wide and 600 ft long replicated five times. Highest yields of safflower were obtained when a medium pre-irrigation of 18 inches and two supplemental 8-inch crop irrigations were applied. When approximately the same total amount of water was applied in one pre-irrigation or in a pre-irrigation and one supplemental crop irrigation the yields were significantly lower. This study suggested that maximum safflower yields (on Panoche clay loam soil) depend on readily available soil moisture in the top 4 ft of soil during bud and flowering periods.

R203114 67A

Fischer, B B; Yamada, H; Pomeroy, C R

EFFECTS OF IRRIGATION PRACTICES ON SAFFLOWER YIELD IN SAN JOAQUIN VALLEY

California Agr, Vol 21, No 11, pp 6-7, Nov 1967. 2 p, 4 fig, 3 tab

University of California, Division of Agriculture Science, Fresno

DESCRIPTORS--/ irrigation/ soil moisture/ *irrigation practices/ clay loam/ *supplemental irrigation/ timing/ crop production

IDENTIFIERS--/ *safflower

IRRIGATION

R203141X67A ADVANCES IN WATER HARVESTING
Water Harvesting, the practice of collecting water from an area treated to increase runoff from rainfall and snowmelt, has been utilized in many countries and for a length of time. In the US, however, the expense of building such facilities has prevented use. Increased water needs will undoubtedly lead to increased water harvesting. Four low-cost methods are described. The first, sprayed asphalt catchments, showed considerable promise. They collected nearly 100% runoff precipitation, were strong and durable, and were low cost; however, they gave off oxidation products in regions of high solar radiation and low precipitation. The second, plastic sheeting catchments, were low cost but were not durable unless a protective layer of gravel was used. This decreased the percentage of collection. The third, sodium-treated catchments, was very low cost and may yield more than 70% runoff but created an erosion problem. The last is soil treated with water repellants, the most promising of which is sodium methyl silanolate. Although much research remains, current work has shown costs can be reduced initially to 10¢ per sq yd with an annual maintenance of 2¢ per sq yd.

R203141X67A

Myers, Lloyd E

RECENT ADVANCES IN WATER HARVESTING

J Soil Water Conserv, Vol 22, No 3, pp 95-97, May-June 1967.
3 p, 2 fig

U S Water Conservation Lab, Phoenix, Ariz

DESCRIPTORS--/ plastics/ runoff/ sodium compounds/ spraying/ asphalt/ *atmospheric precipitation/ soil stabilization/ emulsions/ repellants/ asphaltic concrete/ rubber/ *water collection systems/ *soil sealants/ *water harvesting/ watersheds (basins)/ sealants/ water costs

IDENTIFIERS--

MATERIALS ENGINEERING

R203056X68A DEVELOPMENT OF NONDESTRUCTIVE TESTING
The past and present status and future development of nondestructive testing are examined. Current definitions limit the scope of nondestructive testing to radiographic, ultrasonic, eddy current, and surface penetration methods; a wider perspective might include such diverse methods as egg candling, specific gravity determinations, glass bottle ringing, leak testing, infrared detection, and X-ray fluorescence spectrography. Historical aspects, activities of testing societies, and current technological developments are reviewed to provide background for a commentary on developing and expanding the art. Future expansion depends on training personnel, research on new methods, and extending the applications of nondestructive testing. Central training centers are needed to coordinate teaching and compete with demand. The paper concludes that the scope of nondestructive testing needs clarification, and a concerted effort is needed to evolve new methods and embrace related techniques of quality control and critical path analysis. Planned development is recommended. Has 18 references.

R203056X68A

Mullins, Leslie

THE DEVELOPMENT OF NONDESTRUCTIVE TESTING

Mater Evaluation, Vol 26, No 6, pp 93-105, June 1968. 13 p, 1 fig, 3 photo, 18 ref

Kodak Ltd, Harrow, Great Britain

DESCRIPTORS-- / *nondestructive tests/ *materials testing/ radiographic inspection/ technologists/ X-ray analysis/ quality control/ inspection/ cracks/ reviews/ research and development/ test procedures/ training/ metals testing/ welded joints/ schools/ technical societies/ bibliographies
IDENTIFIERS--/ ultrasonic tests/ eddy currents/ foreign testing/ Great Britain

R203093X68A CYCLIC CONDENSATION HUMIDITY CABINET

Accelerated corrosion testing of preservative oils and compounds in humidity cabinets does not provide reproducible and repeatable results. Continuous condensation cabinets, such as the Joint Army Navy Specification JAN-H-792 humidity cabinet, salt spray, and fog cabinets are inadequate because of random condensation and washing action of the condensate on test specimens. Improved cabinets, using a controlled temperature differential to establish condensation, intensify corrosion conditions to the extent of changing the relation of test exposure with actual humid environment. Corrosion tests should simulate actual exposure conditions on an accelerated basis. These conditions can be achieved only by reproducing the diurnal cycle with independent controls for air temperature, air humidity, and sample temperature. A JAN-H-792 humidity cabinet was modified to provide these controlled conditions. This cabinet produces uniform reproducible corrosion patterns on test specimens, and can be adapted for evaluating finishes, treatments, painted surfaces, preservatives, and packaging films. Construction details, operating data, and limited performance data of the cabinet are given.

R203093X68A

Minuti, D V and Bowen, J H

A CONTROLLED CYCLIC CONDENSATION HUMIDITY CABINET

Mater Res Stand, Vol 8, No 6, pp 33-41, June 1968. 9 p, 10 fig, 1 tab, 6 ref

Naval Air Development Center, Washington, D C

DESCRIPTORS--/ *materials testing/ *testing machines/ weathering/ test procedures/ *environmental tests/ condensation/ temperature/ protective coatings/ paints/ *humidity/ exposure/ corrosion/ temperature control/ preservation/ test facilities

IDENTIFIERS--/ accelerated testing/ testing equipment/ *corrosion tests/ *humidity cabinets

R203048X68A UNPRECEDENTED TEHACHAPI PUMP PLANT LIFT

The Tehachapi Pumping Plant, located at the north base of the Tehachapi Mountains 70 mi morth of Los Angeles, will lift 4,100 cfs of water about 2,000 ft. This will be the highest pump lift in the USA and 1 of the largest in the world. Millions of dollars in additional construction costs could result from overconservative methods in designing the discharge line for the internal pressure, and in the elastic stability analysis for external pressure. Therefore, the most recent research work in many varied fields of engineering was introduced into practical construction. This paper presents some of the concepts used to refine the design of the discharge line tunnels, and the computer programs used to optimize the final design.

R203048X68A

Jain, Ravinder K; Griffith, A R; Stephens, M N

THE UNPRECEDENTED LIFT--TEHACHAPI PUMPING PLANT DISCHARGE LINES

Proc, Western Water Power Symp, pp B-51-B-61, Apr 1968. 11 p, 6 fig, 8 ref

California State Department of Water Resources, Sacramento

DESCRIPTORS--/ *lift/ *high pressures/ pipelines/ *pressure tunnels/ *tunnels/ head losses/ water hammer/ tunnel linings/ models/ model tests/ hydraulics/ stiffening/ surge tanks/ external forces/ internal forces/ tunnel design/ water tunnels (conveyance)/ *steel linings/ hydrostatic pressures/ engineering geology/ pumping plants
IDENTIFIERS--/ *discharge lines/ *pressure head/ *Tehachapi Pump Plant, Calif/ California/ cost savings

R203049X68A PUMP SELECTION FOR TEHACHAPI PUMP PLANT
Many complex problems were encountered in selecting the pumps for the high lift of the monumental Tehachapi Pumping Plant in California. A single-lift concept was chosen and a special research and development program carried out to select the optimum type of pump and to prepare specifications for fabrication. The program included special model testing, as well as analytical and other studies. After selection of a 4-stage centrifugal pump, manufacturers were prequalified and commissioned to build large-scale models. These models were tested in an independent laboratory, and results used to evaluate efficiency in relation to pump cost. The program resulted in receipt of bids for equipment having substantially greater efficiency than available heretofore. Basic pump design parameters are discussed.

R203049X68A

Miller, David R

SELECTION OF FOUR-STAGE PUMPS FOR THE TEHACHAPI PUMPING PLANT

Proc, Western Water Power Symp, pp B-1-B-11, Apr 1968. 11 p, 5 ref

Daniel, Mann, Johnson, and Mendenhall, Los Angeles, Calif

DESCRIPTORS--/ *pumps/ *pumping plants/ high pressures/ wear resistance/ *centrifugal pumps/ hydraulic models/ model tests/ reliability/ costs/ vibrations/ hydraulic transients/ efficiencies/ cavitation/ pump tests/ cost comparisons/ specific speed/ lift

IDENTIFIERS--/ alternative costs/ *high head/ evaluation/ *Tehachapi Pump Plant, Calif/ California

R203068X68A VALVE ENGINEERING FOR WATER SUPPLY
Engineering development is a continuous process derived either singly or collectively from improvements in design, materials, or application. The valve manufacturing industry is attaining more efficient production through rationalization, a process of simplification and standardization. Design improvement is the most obvious field of development and has 4 objectives: (1) improved hydraulic or mechanical performance; (2) minimum dimensional requirements, taking advantage of improved qualities of established and new materials; (3) use of new manufacturing methods to increase productivity; and (4) maximum standardization and interchangeability of components. Improved existing materials and newly developed better materials have influenced valve manufacturing. The range of application of valves can be extended through a more extensive knowledge of hydraulic flow conditions. The general background of valve development is reviewed, and the effect of these developments on the design and use of gate, butterfly, air, check, regulating, and terminal discharge valves is discussed.

R203068X68A

Miller, E

DEVELOPMENTS IN VALVE ENGINEERING FOR WATER SUPPLY

J Inst Water Eng, Vol 22, No 2, pp 91-128, Mar 1968. 38 p, 19 fig, 1 tab, 9 ref, disc

Glenfield and Kennedy, Ltd, Kilmarnock, Scotland

DESCRIPTORS--/ *valves/ *butterfly valves/ *check valves/ *gate valves/ mechanical engineering/ manufacturing/ design/ materials/ water supply systems/ corrosion control/ cavitation/ flow/ hydraulics/ water seals/ hydrodynamics/ *hydraulic gates and valves/ hollow jet valves/ needle valves/ high pressure valves

IDENTIFIERS--/ Great Britain/ foreign research/ hydraulic valves/ valve seats

R203099X68A VIBRATION & BALANCING OF FLEXIBLE SHAFTS
Vibration of rotating flexible shafts is a very important problem in many branches of engineering. A rotating shaft can experience a whole range of vibration phenomena. Vibration may be forced, transient, or self-excited. Forced vibration (or whirling) resulting from unbalance is the most important common type of vibration in a rotating flexible shaft and is discussed in this paper. A rotating shaft suffers from unbalance if its mass axis does not coincide exactly with the elastic axis. The following topics are reviewed: (1) motion of a rigid rotor supported on a massless flexible shaft; (2) motion of a massive flexible rotor; (3) balancing flexible shafts; (4) departures from axial symmetry; (5) other aspects of shaft vibration such as oil whirl, massive flexible foundations, gyroscopic and rotary inertia effects, acceleration and retardation of shafts, and axial torque and thrust; and (6) methods of measuring shaft vibration. Has 93 references.

R203099X68A

Bishop, R E D and Parkinson, A G

VIBRATION AND BALANCING OF FLEXIBLE SHAFTS

Appl Mech Rev, Vol 21, No 5, pp 439-451, May 1968. 13 p, 1 fig, 93 ref

University College, London, Great Britain

DESCRIPTORS--/ *mechanical engineering/ *vibrations/ motion/ rotation/ *shafts (machinery)/ mechanical equipment/ rotating components/ torque/ bibliographies/ moments of inertia/ transients/ accelerating/ frequency/ thrust/ deceleration/ analysis/ damping/ bearings/ generators/ turbines/ investigations/ measurement/ *hydraulic machinery
IDENTIFIERS--/ foreign research/ Great Britain/ harmonics/ gyroscopic effects/ *balancing/ *rotors/ turbogenerators

R203058 68A CONTROL OF WEATHER MODIFICATION
This paper discusses the administration and legal aspects of weather modification. Although society favors elimination or suppression of hail or tornadoes, disputes will arise over attempts to increase precipitation. Ligitation between conflicting interests can be anticipated; appropriate liability doctrines must be formulated and applied to resolve these conflicts. Weather modification in the United States is traced from a discovery in 1946 that dry ice and silver iodide induce precipitation in supercooled clouds. Development of private law doctrines and cases involving weather modification are discussed; 23 states have enacted statutes dealing specifically with weather modification. Congress and Federal agencies have been concerned primarily with investigating and coordinating weather modification rather than regulating it. Proposed legislation now before Congress is discussed, and possible legal and administrative solutions to control weather modification are analyzed. An organization under the United Nations should be established to exercise control of weather modification since weather has no geographical boundaries. Has 145 references.

R203058 68A

Corbridge, James N Jr and Moses, Raphael J

WEATHER MODIFICATION: LAW AND ADMINISTRATION

Natur Resources J, Vol 8, No 2, pp 207-235, Apr 1968. 29 p, 145 ref

University of Colorado, Boulder

DESCRIPTORS-/ *weather modification/ weather/ rain/ rainfall/ storms/ bibliographies/ governments/ *administration/ *laws/ control/ cloud seeding/ benefits/ history/ *meteorology/ *artificial precipitation

IDENTIFIERS--/ *legal aspects/ legislation

R203121X67A AGROMETEOROLOGICAL ASPECTS OF DEW

A review of the literature on dew discusses the following: dew measurement, dew and plant development, dew forecasting, and dew and plant pest development. The results of a number of dew measurement studies are presented, the majority of which deal with amount rather than duration. No standardized method of dew recording exists today making data comparison impossible. The effects of dew on plant development are reviewed with particular stress on its importance in arid and semiarid lands. Effects of relative humidity on dew formation, suppression of transpiration, dew assimilation through leaves and amount of dew compared to quantity of rainfall are reported. Methods of dew forecasting are given based on some combinations of the following factors: nocturnal cooling rate, dew point, wind speed, air temperatures, vapor pressure, and radiation. Several accounts are given of dew formation being favorable to the infection processes of plants by bacteria and fungi. Specific examples include wheat stem rust, apple scab fungus, downy mildew of sugar beet, and the late blight fungus. Has 151 references.

R203121X67A

Wallin, Jack R

AGROMETEOROLOGICAL ASPECTS OF DEW

Agr Meteorol, Vol 4, No 2, pp 85-102, 1967. 18 p, 1 tab, 151 ref

U S Department of Agriculture, Ames, Iowa

DESCRIPTORS--/ **evapotranspiration/ diseases/ bacteria/ plant (botany)/ *dew/ humidity/ *dew point/ hygrometry/ rusts/ air temperature/ vapor pressure/ bibliographies/ radiation/ plant diseases/ mildews/ scabs/ fungi/ microenvironment/ blights/ wind velocity/ plant growth**

IDENTIFIERS--

R203124 67A SYNOPTIC CLIMATOLOGY OF THE WEST

A synoptic climatology of precipitation resulting from 645 upper closed lows was developed for the intermountain area of the West for the winter months of December, January and February. The deviation of the synoptic climatology was carried out by electronic computer. Precipitation amounts at about 280 stations for 12 hour periods, centered at upper-air observation times and expressed as percentages of 7-day normal station amounts, were related to the positions of low centers at the 700 millibar level through the use of a moving grid system. The upper lows were classified into three intensity categories according to the departure from normal of the central height. For each category, the average precipitation amount, extent, and frequency of occurrence over the area of the grid system was presented. The area of maximum precipitation was found just southeast of the centers of intense 700 millibar lows. As the intensity of the low center decreased, the frequency of precipitation diminished and the area of maximum frequency shifted to positions south and west of the center.

R203124 67A

Jorgenson, Donald L; Klein, William H; Korte, A F

A SYNOPTIC CLIMATOLOGY OF WINTER PRECIPITATION FROM 700-mb LOWS FOR INTERMOUNTAIN AREAS OF THE WEST

J Appl Meteorol, Vo. 6, No 5, pp 782-789, Oct 1967. 8 p, 11 fig, 13 ref, append

Weather Bureau, ESSA, Silver Spring, Md

DESCRIPTORS--/ meteorological data/ climatology/ synoptic analysis/ computer programs/ precipitation (atmospheric)/ weather patterns/ climatic data

IDENTIFIERS--/ weather data/ precipitation rate/ climatic formulas/ intermountain west, USA/ Western United States

R203133 68A VARIATION IN SUMMER RAINFALL DISTRIBUTION
In southeastern Arizona, almost all summer rainfall results from widely-scattered high-intensity afternoon or evening thunderstorms of limited areal extent. On the 58-sq-mi Walnut Gulch Watershed in Tombstone, Arizona, about 70% of the annual rainfall of 11-1/2 inches for the 11-yr period of record (1954-1964) fell in July, August, and early September. Over 95% of the annual runoff occurred during this same period. In contrast, about 5% of the rainfall occurred in April, May, and June, and about 25% in the remaining 6-1/2 months. Although highly variable, the July-August rainfall represented the most dependable source of water to the Walnut Gulch Watershed, and rainy and drought periods within this 2-month period most influenced plant growth and surface conditions and indirectly influenced runoff. On the average, significant rainfall was recorded on some part of the watershed on 40% of the days during this critical period. The maximum frequency was 3 out of every 4 days in 1955 and the minimum was 3 out of every 10 days in 1960. The wettest year was 1955, with a continuous rainy period of 47 days, whereas the driest was 1960, with the longest rainy period lasting 5 days. The longest summer drought during the period of record occurred in 1962, when no rain fell for 17 days in August.

R203239 68A

Weaver, R L

METEOROLOGY OF MAJOR STORMS IN WESTERN COLORADO AND EASTERN UTAH

ESSA Tech Memo WBTM HYDRO 7, Weather Bur, Jan 1968. 75 p, 39 fig, 13 tab, 12 ref

ESSA Weather Bureau, Washington, D C

DESCRIPTORS--/ climatology/ hydrology/ meteorology/ moisture/ *storms/ mountains/ *rainfall intensity/ topography/ *rainfall/ advection/ air circulation/ air masses/ marine air masses/ orography/ storm structure/ precipitation (atmospheric)/ *rainfall disposition/ *weather patterns/ winds
IDENTIFIERS--/ western Colorado/ eastern Utah

R203210 68A CHEMICAL COMPOSITION OF PRECIPITATION, N C AND VA
Results of chemical analyses of monthly atmospheric precipitation samples from 12 collection sites over a 2-yr period show small annual changes in loads and geographical distribution of sulfate and nitrate in the piedmont and coastal plains of North Carolina and southern Virginia. Sulfate and nitrate loads were 7 and 2 tons respectively, per sq mi in the interior and less near the coast, and chloride loads were 2.1 and 1.8 respectively. Cation concentrations differ considerably from year to year and apparently depend on soil dust. Reaction of an acidic sulfur-containing aerosol with an alkaline calcium source is probably a principal control on rainfall alkalinity and pH. Ions in rainfall contribute substantially to surface-water quality; precipitation input and stream export for 4 rivers show that rainfall sulfate is equal to sulfate discharged, whereas nitrate in rain exceeds stream nitrate. Cation contributions from rainfall range from 20% for potassium to 50% for calcium. Presence of 3 types of aerosols--marine, acidic, and alkaline--are inferred from results of the study. Has 15 references.

R203210 68A

Fisher, Donald W

ANNUAL VARIATIONS IN CHEMICAL COMPOSITION OF ATMOSPHERIC PRECIPITATION, EASTERN NORTH CAROLINA AND SOUTHEASTERN VIRGINIA

Geol Surv Water-Supply Pap 1535-M, pp M1-M21, 1968. 21 p, 17 fig, 1 tab, 15 ref

Geological Survey, Washington, D C

DESCRIPTORS--/ rainfall intensity/ *ions/ sulfates/ nitrates/ aerosols/ leaching/ drainage/ water quality/ salinity/ streamflow/ ecological distribution/ *precipitation (atmospheric)/ *chemistry of precipitation/ North Carolina/ watersheds (basins)/ ion transport

IDENTIFIERS--/ *acidic rainfall/ nitrate load/ chloride load/ sulfate load/ *alkaline soil dust/ cation content

R203224 67A NUCLEAR RADIATION SNOW GAGE
The measurement of water stored in snowpacks is important to determine the efficient utilization of this water. Various methods have been used for this measurement but have not provided accuracies sufficient for precision analyses. Nuclear radiation is shown to be a useful tool for nondestructive water equivalent measurement. The scintillation detector was selected as a desired instrument, and the selection criteria, design features, and performance are presented. Although a unit of relatively high cost, this detector is shown to be capable of arbitrarily high resolution.

R203224 67A

McKean, George A

A NUCLEAR RADIATION SNOW GAGE

Bull 13, Univ Idaho, Aug 1967. 48 p, 15 fig, 10 ref

University of Idaho, Moscow

DESCRIPTORS--/ *snow/ *snow surveys/ measuring instruments/ attenuation/ density/ snowmelt/ radio waves/ water yield/ moisture content/ radiation measurement/ gamma rays/ precipitation gages/ *nuclear moisture meters/ remote sensing/ snowpacks/ radioisotopes

IDENTIFIERS--/ scintillation counters/ *snow gages

R203239 68A MAJOR STORMS IN WESTERN COLORADO, AND EASTERN UTAH
The 42 most intense general storms in eastern Utah and western Colorado since 1899 are studied in relation to the observed or estimated broad-scale upper air circulation patterns and sources of moisture. The report summarizes individual analyses of the storms. Storms are typed by reference to the behavior of the 500-mb patterns. The role of upper Lows in transporting moisture is emphasized. Indices are developed which evaluate storm moisture, temperature and influence of topography. The relative importance to the precipitation sequence of peak moisture versus proximity of upper Lows or troughs is compared. Moisture source regions are related to storm type and season. Local topographic effects are summarized by upper wind direction. Other relationships between various factors are discussed.

R203239 68A

Weaver, R L

METEOROLOGY OF MAJOR STORMS IN WESTERN COLORADO AND EASTERN UTAH

ESSA Tech Memo WBTM HYDRO 7, Weather Bur, Jan 1968. 75 p, 39 fig, 13 tab, 12 ref

ESSA Weather Bureau, Washington, D C

DESCRIPTORS--/ climatology/ hydrology/ meteorology/ moisture/ *storms/ mountains/ *rainfall intensity/ topography/ *rainfall/ advection/ air circulation/ air masses/ marine air masses/ orography/ storm structure/ precipitation (atmospheric)/ *rainfall disposition/ *weather patterns/ winds
IDENTIFIERS--/ western Colorado/ eastern Utah

R203248 68A COMPOSITION OF PRECIPITATION, S E ONTARIO, CANADA
Analyses of bulk precipitation of rainfall and snowfall from 12 sampling sites in S E Ontario are presented and compared with similarly derived results in other areas. The precipitation contains large amounts of dissolved cations and generally higher concentrations of some anions than previously reported. Contents of Si0 sub 2, Al, and Fe are especially high, although in snow, silica is absent and aluminum is quite high. Areal differences is silica content appear to be associated with local differences in lithology of the weathered rocks and soils. Iron is probably derived from atmospheric dust. Lithological differences are also reflected in the significantly higher nitrate-nitrogen concentrations in the limestone area. The content of sulfate is snowfall is high: this is considered to be a function of climatic and industrial causes. Has 16 references.

R203248 68A

Rutherford, G K

A PRELIMINARY STUDY OF THE COMPOSITION OF PRECIPITATION IN S E ONTARIO

Can J Earth Sci, Vol 4, No 6, pp 1151-1160, Dec 1967. 10 p, 1 fig, 4 tab, 16 ref

Queen's University, Kingston, Ontario, Canada

DESCRIPTORS--/ *rainfall/ leaching/ limestones/ rocks/ cation exchange/ geochemistry/ *chemical properties/ bibliographies/ *snowfall/ soil formation/ chemistry of precipitation/ *petrography/ *precipitation (atmospheric)

IDENTIFIERS--/ atmospheric dust/ Ontario, Canada/ dissolved cations/ rock weathering

R203249 67A BIBLIOGRAPHY: ESSA HYDROMETEOROLOGICAL PUBLICATIONS
Lists 105 ESSA publications pertinent to the joint fields of hydrology and meteorology. This bibliography is especially intended to serve the engineer by bringing to his attention the publications of hydrometeorological material that he often requires. General subjects include: Climatological Observations and Data, Liquid Water Content of Clouds in Storms, Maximum Persisting Dewpoints, Drought, Evaporation, Floods, Hydrologic Cycle, Hydrologic Networks, Precipitable Water, Computed Precipitation, Depth-area-duration Analysis, Excessive and Maximum Observed Precipitation, Mean and Normal Precipitation, Precipitation Measurements, Probable Maximum Precipitation, Radar, Solar and Sky Radiation, Rainfall Frequency, Relative Humidity, River and Flood Forecasting, River Stages, Runoff, Snow, Station History, Storms, Storm Surges, Streamflow Frequency Analyses, Temperature, Water Management, Water Supply Forecasts, and Wind.

R203249 67A

Paulhus, J L H

ANNOTATED BIBLIOGRAPHY OF ESSA PUBLICATIONS OF HYDROMETEOROLOGICAL INTEREST

Weather Bur, Office Hydrol Tech Memo WBTM HYDRO-6, Nov 1967. 27 p

ESSA Weather Bur, Washington, D C

DESCRIPTORS--/ *bibliographies/ *hydrology/ *meteorology/ climatology/ clouds/ dew point/ droughts/ evaporation/ radar/ runoff/ snow/ storms/ streamflow/ temperature/ floods/ hydrologic cycle/ radiation/ winds/ river forecasting/ water management (applied)/ humidity/ precipitation (atmospheric)
IDENTIFIERS-- / *hydrometeorology/ water supply forecasting

R203252X68A RAINFALL REDUCTION BY SMOKE FROM SUGARCANE FIRES
Rainfall and the number of shower rain days at 7 inland stations near the northeastern coast of Australia are compared with similar data for a nearby coastal station. Shower rains and shower rainfall have decreased at the inland stations but not at seaward stations out of the direct path of smoke from the cane fires. Rainfall reduction at the inland stations averages about 2 in., or 25% for the 3-month harvest period. The inland stations are downwind from an area where intensive burning of sugarcane produces smoke which may affect local precipitation. The data selected include only shower rainfall (0.05 to 1 in.) falling in onshore winds. Data for March and for the sugarcane harvest season of September-November are tabulated and compared on graphs. The data show changes during the last 60 yr in the inland rainfall pattern during the sugarcane harvesting season that differ from patterns seaward of the coast. Changes seem to be greatest since 1930, coinciding with major increases in cane production. Because changes in the March rainfall pattern are also sizable but erratic, any conclusions must be tentative. It is suggested that similar examinations of rainfall patterns and trends should be made in other areas where sugarcane is grown.

R203252X68A

Warner, J

A REDUCTION IN RAINFALL ASSOCIATED WITH SMOKE FROM SUGAR-CANE FIRES--AN INADVERTANT WEATHER MODIFICATION

J Appl Meteorol, Vol 7, No 2, pp 247-251, Apr 1968. 5 p, 5 fig, 2 tab, 9 ref

Commonwealth Scientific and Industrial Research Organization, Sydney, Australia
DESCRIPTORS--/ *weather modification/ *cloud seeding/ microclimatology/ climatology/ weather/ meteorology/ *smoke/ storms/ rainfall/ Australia/ *precipitation (atmospheric)/ distribution patterns/ sugarcane/ air circulation/ foreign reserch

IDENTIFIERS--/ *rainfall reduction/ condensation nuclei

R203277 68A CESIUM-144 AND STRONTIUM-90 RAINOUT RELATIONS
Analyses were made of time and space distribution of the concentrations of cesium-144 and strontium-90 in 1963 convective storms in Illinois. A network of 16 automatic rainwater samplers were operated in conjunction with recording rain gages and weather radar sets. Wide time and space variabilities were found in the distribution pattern of radioactive rainout. The ratio of cesium-144 to strontium-90 was appreciably lower at the end of rain storms than at or near the beginning. Although cause for this trend was not determined, possible influences are: (1) entrainment of surface-polluted air that is high in cesium-144 into the forward edge of stream systems, and (2) differences in the affinity of cesium-144 and strontium-90 particulates for various sizes of cloud droplets and raindrops. Use of the observed ratio between cesium-144 and strontium-90 as a reliable indicator of debris age, and of atmospheric source of radioactive rainout in rainwater, is questionable until verified by further research.

R203277 68A

Huff, F A and Stout, G E

RELATION BETWEEN CESIUM-144 AND STRONTIUM-90 RAINOUT IN CONVECTIVE RAINSTORMS

Tellus, Vol 20, No 1, pp 82-87, 1968. 6 p, 4 fig, 4 tab, 4 ref

Illinois State Water Survey, Urbana

DESCRIPTORS--/ raindrops/ storms/ instrumentation/ meteorology/ rainfall/ sampling/ convection/ atmospheric physics/ *cesium/ *fallout/ *strontium radioisotopes/ Illinois/ radiochemical analysis/ chemistry of precipitation/ radioactivity techniques

IDENTIFIERS--/ cesium isotopes/ *rainout/ *nuclear debris

R203215 68A MARGINAL ECONOMIC ANALYSIS IN RECREATION PLANNING

Recreation visitation and facility cost data were analyzed for 3 reservoirs in the Ohio River Valley to derive a method for selecting the optimum level of recreation facility development by marginal economic analysis. The visitation data were used to determine factors expressing the time distribution of facility use over the day, week, and year and the number of recreation visitors who could be accommodated per unit area. The facility cost data were used to estimate annual cost and marginal cost as functions of annual visitation. The marginal cost curve was found to have a characteristic U shape and depend on the size of the facility and the density of the surrounding population. Potential visitation to a large facility was estimated and converted to a potential benefit by a unit value based on travel cost. A method was developed for estimating actual visitation to a smaller facility as limited by size restrictions. The costs of providing a larger facility could then be compared with additional benefit from the greater number of visitors attracted to select the optimum facility size. Contains 31 references.

R203215 68A

Sirles, John Ellis III

APPLICATION OF MARGINAL ECONOMIC ANALYSIS TO RESERVOIR RECREATION PLANNING

Res Rep No 12, Univ Ky, 1968. 99 p, 14 fig, 19 tab, 31 ref

University of Kentucky, Lexington

DESCRIPTORS--/ *recreation/ planning/ project planning/ water resources development/ *cost comparisons/ *recreaction demand/ marginal benefits/ economic efficiency/ *marginal costs/ recreation facilities/ bibliographies

IDENTIFIERS--/ psychological aspects/ cost curves

R203221X67A LOCAL WATER SUPPLY BENEFIT-COST ANALYSIS

Communities facing an industrial-municipal water shortage have two broad courses: either private or public financing of water-replacement projects. Whether a community could supply water at a lower cost can be decided by a benefit-cost analysis (differing from analyses for Federal projects). The annual benefit from a community project is the present value of the annual cost savings that would result from the non-undertaking of the privately-financed alternatives. The average annual cost to the community is the annual net cash outlay for the purchase of water from the community project at a price just sufficient to cover the project costs. The cost of private alternatives is discounted by the corporate costs of capital; the cost of the community project, by the community's costs of capital. A direct consequence of the corporate income-tax structure is that the benefit-cost ratio will always be greater than unity if the returns to scale are constant and if both the community and corporate costs are discounted at the same interest rate. A numerical example based on the corporate tax structure in Louisiana demonstrates that a community-financed project, with its lower costs of capital, almost always will be more favorable than a private one.

R203221X67A

Stober, W J and Falk, L H

A BENEFIT-COST ANALYSIS OF LOCAL WATER SUPPLY

Land Econ, Vol 53, No 2, pp 328-335, Aug 1967. 8 p, 1 fig, 1 tab, 6 ref

University of Louisiana, Baton Rouge

DESCRIPTORS--/ *capital costs/ *cost comparisons/ depreciation/ benefit-cost ratios/ unit costs/ cost-benefit analysis/ diseconomies of scale/ *cost-benefit theory/ discount rate/ return to scale/ annual costs/ tax rate

IDENTIFIERS--/ *benefit-cost analysis

PROJECT PLANNING

R203222 68A COMPUTER ECONOMIC ANALYSIS OF FLOOD DETENTION STORAGE
A digital computer procedure for preliminary analysis of the economic justification of reservoir storage for flood control was developed and applied in an illustrative sample study. Given a specified reservoir site and a downstream flood plain divided into planning units, the University of Kentucky Planning Program III selects the economically efficient reservoir storage and associated combination of channel improvement, flood proofing, land-use management, and residual flooding for each downstream planning unit, stage by stage throughout the life of the project. A complete design and cost estimate of an earth dam with appurtanent structures is completed by the program. The program does not attempt final measure design but isolates those combinations of measures for which detailed analysis is warranted. Provided are a description of basic Program logic, a complete listing in Fortran IV, and a sample application to evaluate alternative flood control measures along the South Fork of the Licking River, Kentucky. Contains 23 references.

R203222 68A

Villines, James Ray

ECONOMIC ANALYSIS OF FLOOD DETENTION STORAGE BY DIGITAL COMPUTER

Res Rep 9, Univ Ky, 1968. 238 p, 12 fig, 22 tab, 23 ref, 2 append

University of Kentucky, Lexington

DESCRIPTORS--/ *earth dams/ flood plains/ digital computers/ spillways/ land management/ project planning/ right-of-way/ *flood control/ channel improvement/ non-structural alternatives/ *floodproofing/ scheduling/ hydrographs/ stream improvement/ economic justification/ flood plain zoning/ land use/ bibliographies
IDENTIFIERS--/ Licking River, Ky

ROCK MECHANICS

R203045 68A NEW CONSIDERATIONS ON THE VAIONT SLIDE
Published opinions on the Vaiont rock slide are reviewed with particular attention given to the chair-like shape of the slip surface. Investigations indicated no clay existed on the slip surface and the lower western part was horizontal. New calculations, including equilibrium factors not used previously, show friction values to maintain equilibrium are small. The calculations also indicated a questionable validity for static recalculations of the slide, especially since such calculations do not explain different phenomena occurring during reservoir level variations. By considering the slide as a creep phenomena, stabilization could develop in certain cases with constant or slowly reduced load, and in other cases, the sliding mass would accelerate with weakening, loss of bond, or material fatigue. Progressive failure assumed to occur at Mount Toc can also be related to creep phenomena. Recent investigations indicated the final high slide velocity was due to water thrust in the joints, resulting in a spontaneous loss of friction. The mass thixotropy effect may have played a minor role in the Mount Toc slide, but appears to occur frequently in jointed media. Has 87 references.

R203045 68A

Muller, L and Fairhurst C

NEW CONSIDERATIONS ON THE VAIONT SLIDE

Rock Mech Eng Geol, Vol VI, 1-2, 1968. 90 p, 25 fig, 1 tab, 87 ref

DESCRIPTORS--/ *rock mechanics/ *landslides/ sliding/ thixotropy/ stability analysis/ disasters/ slopes/ engineering geology/ creep/ rheology/ rocks/ mathematical analysis/ friction/ bibliographies/ geology/ clays/ water table/ shear strength/ ground water/ reservoirs/ concrete dams
IDENTIFIERS--/ slip surface/ *slope stability/ *rock slope stability/ *rockslides/ *Vaiont Valley, Italy

R203080 67A ROCK ELASTICITY IN PRESSURE TUNNEL DESIGN
Elastic properties of stratified anisotropic rock were determined using a method combining theoretical and field investigations. The procedure was applied in designing the Ingursk pressure tunnel in the Caucasus Mountains, USSR. Formulas were derived for determining elasticity and displacement of rock using the solution of the orthotropic plate problem where a circular opening becomes elliptical under uniform internal load. Hydrostatic pressure chamber tests were conducted in a gallery excavated in a solid, layered limestone similar to rock in the tunnel route. Field tests showed that elasticty modulus parallel to rock stratification is 1.8 to 3.5 times higher than in the perpendicular direction. Elasticity modulus in intermediate directions was calculated. Use of this method improves pressure tunnel design because actual properties of the surrounding medium are considered.

R203080 67A

Khachikian, G G

DETERMINATION OF THE ELASTIC CHARACTERISTICS OF STRATIFIED ANISOTROPIC ROCK FOR PRESSURE TUNNEL DESIGNS

Gidrotekh Stroit, No 9, pp 26-28, 1965. Transl from Russ, Bur Reclam Transl 724, Nov 1967. 9 p, 2 fig, 2 tab, 5 ref

DESCRIPTORS--/ elasticity/ *elasticity modulus/ rock excavation/ rock mechanics/ rocks/ limestones/ stratification/ anisotropy/ tunnels/ beds (geology)/ *tunnel design/ tunnel linings/ *pressure tunnels/ stress distribution/ stress/ strain/ deformation/ *displacements/ mathematical analysis/ foreign design practices/ field tests/ penstocks
IDENTIFIERS--/ rock properties/ ring displacements/ USSR/ pressure chamber test/ Ingursk Powerplant, USSR/ internal loads

R203151X68A SWELLING CHARACTERISTICS OF ROCK
Unsupported excavations in clays, shales, marls, and mudstones may encounter difficulties from swelling upon exposure to moisture. The properties of rock affecting swelling are discussed and a simiple test is described for measuring the swelling of a rock specimen immersed in water. The relationships between void index (percent absorption or saturated moisture content), unit weight, and seismic wave velocity are examined. Swelling pressures are estimated from modulus of elasticity and swelling strain. There are various methods for scaling-up swelling measurements to determine the potential swelling of a rock mass. Seismic wave velocity is dependent upon void content, and can be used to estimate the void index for an in situ rock mass. Rock mass porosity and density may be estimated from the void index and unit weight. Potential volume swelling of a rock mass may be estimated by considering the volume of voids including fissures in the rock mass and the swelling potential of the rock. Examples are given of estimating potential volume swelling of rock and swelling pressures.

R203151X68A

Duncan, Neil; Dunne, Margaret H; Petty, Stuart

SWELLING CHARACTERISTICS OF ROCK

Water Power, Vol 20, No 5, pp 185-192, May 1968. 8 p, 17 fig, 1 tab

Portsmouth College of Technology; Kingston College of Technology, Great Britain

DESCRIPTORS--/ *swelling/ sedimentary rocks/ void ratios/ clays/ marl/ wave velocity/ seismic waves/ porosity/ expansion/ *expansive forces/ *rock mechanics/ stress/ strain/ voids/ *rock excavation/ tunnels/ test procedures/ fractures/ stress relieving/ tunnel linings/ moisture/ excavation/ shales/ clay shales/ engineering geology
IDENTIFIERS--/ rock properties/ rock slope stability/ swelling pressures/ underground openings

R203011 66A TUCSON WASTEWATER RECLAMATION PROJECT
This first annual report of the Tucson Wastewater Reclamation Project contains area maps, tables, graphs, design drawings, forms, and other pertinent data, along with a summary of the work produced during the first yr of the grant period. The report is made in compliance with Water Pollution Control Demonstration Project Grant No WPD-108-01-65, dated June 10, 1965, awarded to the City of Tucson, Arizona, Department of Water and Sewers. The phases of the TWRP may be divided into (1) the construction, operation and monitoring of a tertiary treatment facility in the form of a pilot filter and (2) the accumulation and evaluation of analytical, physical and documentary evidence from the study of wells within the outlined project area. The primary purpose of the project is to demonstrate the chemical, microbiological and virological safety and aesthetic acceptability of including renovated wastewater as a dependable and substantial portion of the future water supply for Metropolitan Tucson.

R203011 66A

Davis, Gordon E and Stafford, John F

FIRST ANNUAL REPORT, TUCSON WASTEWATER RECLAMATION PROJECT, JUNE 1965-JUNE 1966

Tucson Wastewater Reclam Proj Rep, July 1966. 66 p, 17 fig, 7 plate, 2 tab

Water & Sewers Department, Tucson; University of Arizona, Tucson

DESCRIPTORS--/ *water reuse/ projects/ sewage treatment/ wells/ water quality/ water filters/ effluents/ water pollution/ waste disposal/ *waste water/ *waste water treatment/ municipal wastes/ water pollution treatment/ treatment facilities/ water wells/ hydrogeology/ irrigation water/ microbiology/ waste treatment
IDENTIFIERS--/ *Tucson, Ariz/ effluent-charge system/ *waste water reclamation

R203020 67A ACTIVATED SLUDGE BACTERIA CHARACTERISTICS
The replica-plating technique and Lochhead's nutritional method were combined in exploratory experiments to test their feasibility as useful means for characterizing the aerobic heterotrophic flora of activated sludge and to minimize the burdensome process of isolation, purification, and testing of isolates. In the test run, the method was about 86% reliable at the 0.05 level of significance. About 40% of the total number of bacteria able to grow on an aqueous extract of activated sludge did not grow on media containing glucose, amino acids, growth factors, and inorganic salts. The requirement for activated sludge extract suggested the existence of a requirement for unidentified nutrients contained in the activated sludge extract. This investigation was supported by Research Grant WP-00645-01 from the Federal Water Pollution Control Administration. Has 20 references.

R203020 67A

Prakasam, T B S and Dondero, Norman C

AEROBIC HETEROTROPHIC BACTERIAL POPULATIONS OF SEWAGE AND ACTIVATED SLUDGE, II: METHOD OF CHARACTERIZATION OF ACTIVATED SLUDGE BACTERIA

Appl Microbiol, Vol 15, No 5, pp 1122-1127, Sept 1967. 6 p, 5 tab, 20 ref, disc

Rutgers, The State University, New Brunswick, N J

DESCRIPTORS--/ laboratory tests/ bibliographies/ *bacteria/ microbiology/ biology/ *sewage/ sewage treatment/ *aerobic bacteria/ testing/ nutrient requirements/ *activated sludge/ analytical techniques/ nutrients/ coliforms

IDENTIFIERS--/ activated sludge bacteria/ *replica plating technique/ *Lochhead's nutritional method

R203029 67A BEHAVIOR OF ACTIVATED SLUDGE
The objectives of this research, supported by Public Health Service Research Grant No WP-00787, were: (1) To develop a mathematical model based on a combination of microbiological growth kinetics and process materials balances that quantitatively describe the steady and transient state behavior of the activated sludge process, (2) to test the mathematical model by conducting activated sludge experiments at steady and unsteady state on a laboratory scale using a synthetic substrate, (3) to conduct limited studies of a pilot scale activated sludge system treating domestic sewage in order to determine the applicability of the model to a practical situation, and (4) to formulate predictions, from previous studies, concerning the effects of short-term transients on effluent quality from the activated sludge process. Has 65 references.

R203029 67A

Eckhoff, David W and Jenkins, David

ACTIVATED SLUDGE SYSTEMS: KINETICS OF THE STEADY AND TRANSIENT STATES

Sanit Eng Res Lab, Serl Rep 67-12, Univ of Calif, Dec 1967. 120 p, 44 fig, 21 tab, 65 ref, 4 append

University of California, Berkeley

DESCRIPTORS--/ unsteady flow/ flow/ kinetics/ bibliographies/ laboratory tests/ *sludge/ sanitary engineering/ microorganisms/ bacteria/ sewage/ *sewage treatment/ mathematical models/ *activated sludge/ *biological treatment/ behavior/ microbiology/ sewage bacteria

IDENTIFIERS--/ microbiological growth

R203111 67A DISSOLVED OXYGEN RESPONSE OF A STREAM
This work attempts to predict dissolved oxygen deficits in a stream with known initial conditions by considering the variations in deoxygenation and reaeration coefficients. A hypothetical stream situation is used to establish the significance in predicting dissolved oxygen deficit. Statistical models are formulated and tested for the variations in these coefficients using published data. Simulation techniques using the Monte Carlo method are employed in predicting the probabilitstic variation in dissolved oxygen deficits for known initial conditions and the results are verified with the survey data observed for the Ohio River-Cincinnati Pool reach. The predicted results using a probabilistic model are found to agree with the observed values within practical limits and give more consistent results than conventional methods. Contains 82 references.

R203111 67A

Kothandaraman, Veerasamy

PROBABILISTIC ANALYSIS OF WASTEWATER TREATMENT AND DISPOSAL SYSTEMS

Water Resour Center Res Rep 14, Univ Illinois, June 1968. 153 p, 21 fig, 16 tab, 2 chart, 82 ref

University of Illinois, Urbana

DESCRIPTORS--/ Ohio River/ *dissolved oxygen/ bibliographies/ pollution abatement/ waste disposal/ waste water/ sewage effluents/ water quality/ sewage disposal/ water pollution/ stream pollution/ mathematical models/ *reaeration/ model studies/ *statistical methods/ Monte Carlo method

IDENTIFIERS--/ deoxygenation coefficients

R203112 68A TRACER STUDIES ON RAPID SAND FILTRATION
Instrumentation design and methods devised for using radiotracers, cesium-137 and iodine-131, in a study of variables involved in rapid sand filtration are outlined. Procedures developed for separating particles of sharply defined size ranges are discussed. The pattern of deposition of particles within the filter medium has been observed for a number of different particle sizes. Evidence has been observed that both adsorption and desorption processes occur, and that these processes are associated with the kinetics of particle motion. Results of experiments conducted to define the counting geometry and sensitivity of the radiation detection system are reported. A method for encapsulating the tracer isotope inside the tagged particles and automation of the detector scan of the filter bed with associated data recording are discussed. The many experimental results recorded, with few exceptions, have been found consistent and reproducible.

R203112 68A

Eichholz, G G and Craft, T F

RADIOTRACER STUDIES ON RAPID SAND FILTRATION

Georgia Inst of Technol Completion Rep, Apr 1968. 8 p, 3 fig, 1 drwg

Georgia Institute of Technology, Atlanta

DESCRIPTORS--/ adsorption/ *filtration/ flocculation/ vermiculite/ *sand filters/ water filters/ waste disposal/ waste water/ water treatment/ *radioisotopes/ tracers/ cesium isotopes/ iodine isotopes

IDENTIFIERS--/ *radioactive tracers

R203149 68A WATER BETTERMENT BY GROUND-WATER RECHARGE
Seepage of poor quality water may be a source of ground-water pollution. However, such water may be improved considerably as it moves through the soil. This paper describes installations to control entry of low quality water into the soil and its percolation to and below the ground water. This phenomena is then called seepage not recharge. An important advantage of waste water renovation by recharge is its aesthetic aspect. It is clear that when sewage effluent percolates through the soil to the water table, for practical purposes, it loses its identity and on reaching a well would be pumped as ground water. Such a procedure would probably have greater public acceptance then purifying sewage effluent by other methods where the product, however pure, would carry the connotation of "purified sewage." Assuming amortization and operation costs of recharge basins $1000/acre/yr and a recharge rate of 200 ft/yr the cost of renovating water would be $5/acre-ft. With unfavorable soil or aquifer conditions which permitted only 50 ft/yr the cost could rise to $20/acre-ft. It is noted induced seepage, or ground-water recharge, is being used increasingly to renovate sewage effluent and/or other polluted water.

R203149 68A

Bouwer, Herman

WATER QUALITY IMPROVEMENT BY GROUND-WATER RECHARGE

Agr Res Serv Pap 41, 1968. 22 p, 9 ref

Agricultural Research Service, Phoenix, Ariz

DESCRIPTORS--/ *ground water/ *water quality/ *water pollution/ waste water/ *spreading basins/ recharge wells/ percolation/ microorganisms/ *water treatment/ *water filters/ underground water storage/ sewage effluents/ sewage treatment/ *groundwater recharge/ water filters/ sanitary engineering /waste water treatment/ pit recharge
IDENTIFIERS--

R203220X67A E. COLI SEROTYPES SIGNIFICANCE IN WASTEWATER EFFLUENT

This study on the renovation of wastewater effluent was intended to evaluate the significance of the survival of coliform bacteria and Escherichia coli serotypes in the effluent, to determine the influence of the effluent on the occurrence of coliform bacteria in birds located in the spray area, and to evaluate the effectiveness of this procedure for renovating the effluent by the use of the coliform density for determining the purity of the wastewater. The results showed that in the chlorinated effluent, members of the Klebsiella-Aerobacter group outnumbered E. coli by a ratio of 9:1. It also was found that the sewage effluent irrigation had no influence on the occurrence of coliform bacteria in the wild birds and that percolation of the effluent through the soil to a depth of 2 to 4 ft (51 to 102 cm) is sufficient for reclamation of the effluent to a state where it is practically free of coliform bacteria.

R203220X67A

Glantz, Paul J and Jacks, Thomas M

SIGNIFICANCE OF ESCHERICHIA COLI SEROTYPES IN WASTEWATER EFFLUENT

J Water Pollut Contr Fed, pp 1918-1921, Nov 1967. 4 p, 3 tab, 10 ref

Pennsylvania State University, University Park

DESCRIPTORS--/ sewage effluents/ *water reuse/ water pollution/ E. coli/ chlorination/ *waste water (pollution)/ waste water treatment/ animal wastes (wildlife)/ soil water movement/ *coliforms/ birds

IDENTIFIERS--/ *E. coli serotypes

R203225 68A REMOVAL OF PHOSPHATE FROM DIGESTER LIQUOR

Lime treatment of sludge digester supernatant liquor for removal of phosphate was studied. Batches of raw supernatant liquor and supernatant liquor subjected to bioaeration were treated with high calcium hydrated lime to determine if sludge settleability could be improved by particle nucleation techniques. Variables investigated were phosphate residual, pH level of treatment, lime dosage, settling time, aeration period, return sludge dosage and sludge production. The results indicate pH level to be the principal variable affecting phosphate residual, although some effects were attributed to coprecipitation and sludge dispersion. Generally, treatment to pH of 11 to 12 was required to obtain phosphate residuals in the 20 to 30 ppm range. A settling period of 12 hr following lime treatment produced stable phosphate residuals and effected a practical degree of sludge compaction. Two days of bioaeration reduced lime dosage by 20 to 45% and reduced sludge production by about 45%. The addition of return sludge to supernatant liquor prior to lime treatment increased sludge subsidence rates and reduced waste sludge volume. Practical return sludge dosages ranging from 1.2 to 3.2 times the weight of precipitate formed in the reaction reduced volume of waste sludge by 20 to 42%.

R203225 68A

Parsons, William A and Glennon, J M, Jr

LIME TREATMENT FOR REMOVAL OF PHOSPHATE FROM DIGESTER SUPERNATANT LIQUOR

Water Resour Res Center Bull 7, Va Polytech Inst, 1968, 56 p, 20 fig, 12 ref

Virginia Polytechnic Institute, Blacksburg

DESCRIPTORS--/ sanitary engineering/ sewage/ sewage disposal/ waste disposal/ *sewage treatment/ settling basins/ sludge/ *sludge digestion/ lime/ phosphates/ pH/ digestion tanks/ sedimentation/ *phosphorus/ sewage lagoons/ *sludge disposal/ domestic wastes

IDENTIFIERS--

SANITARY ENGINEERING

R203230X68A USE OF SEWAGE EFFLUENT AT LIVERMORE, CALIFORNIA
Treated sewage effluent from the Livermore municipal system is used to replenish water hazards and to provide water for irrigation of the golf course and fire protection at the golf course and adjacent airport. The 5-mgd plant uses the activated-sludge system and biological filter to remove 86% of the BOD and 96% of the suspended solids. The effluent does not need to be held in oxidation ponds, but flows directly from the final clarifier through the chlorination contact tanks and into the irrigation system. The effluent first goes into 4 artificial lakes that form the water hazards on the golf course. At night, water from the lakes is pumped into the underground system to irrigate the tees, fairways, and greens. The bottoms of the lakes have been left unsealed so the effluent can percolate down to recharge the groundwater. Effluent also is used to irrigate areas near the runways that presently are leased for agriculture. Eventually the system will provide irrigation water for a new 150-acre junior college campus nearby. The high nitrate content of the effluent fosters turf and crop growth. The golf course and airport are expected to produce revenue above operating and debt-retirement costs.

R203230X68A

Parness, W H

GOLF COURSE AND AIRPORT IRRIGATE WITH SEWAGE EFFLUENT

Amer City, Vol 83, No 5, pp 90-92, May 1968. 3 p, 3 illus

City of Livermore, Calif

DESCRIPTORS--/ *sewage effluents/ sewage disposal/ waste disposal/ water treatment/ *water reuse/ sanitary engineering/ filtration/ groundwater/ percolation/ water spreading/ *artificial recharge/ water purification/ irrigation water/ *waste water disposal/ activated sludge/ *reclaimed water/ biological treatment/ induced infiltration/ artificial use
IDENTIFIERS--/ effluent reuse/ biological filters

SOILS ENGINEERING

R203143 68A ENGINEERING PROPERTIES OF LOESS
Published values of engineering properties of loess are scarce according to the author. His paper provides data to summarize and compare such properties for loess from 8 states including Alaska. Loess is an aeolian soil, usually buff colored, composed of loosely arranged angular particles of sand, silt and clay in which silt sized particles predominate. Most particles are coated with thin films of clay which are the major cementing agent of a loess body. A unique feature of loess is its ability to stand in vertical faces. Specific gravity, permeability, bearing capacity and other properties are discussed for different loesses. Well accepted conclusions include: (1) gradation, compaction and classification are very uniform between loess from different areas; (2) inplace densities range from 66 to 104 pcf; (3) consolidation is rapid under load if a loess is saturated, or nearly so; but large settlement is uncommon where such densities are over 90 pcf which figure is a criterion; and (4) shear strength depends greatly on moisture content. Has 23 references.

R203143 68A

Sheeler, J B

SUMMARIZATION AND COMPARISON OF ENGINEERING PROPERTIES OF LOESS IN THE UNITED STATES

Highway Res Rec, No 212, pp 1-9, 1968. 9 p, 7 fig, 1 tab, 23 ref

Iowa State University, Ames

DESCRIPTORS--/ *loess/ *aeolian soils/ soil consolidation tests/ soil physical properties/ soil classifications/ moisture content/ porosity/ *finegrained soils/ grain sizes/ soil shrinkage/ settlement/ soil structure/ soil moisture/ soil texture/ shear strength/ consolidation/ bibliographies/ soil density
IDENTIFIERS--/ soil plasticity

R203144X67A STRUCTURES ON SWELLING SOILS
Deformation and serious damage to buildings constructed at locations underlain by swelling Pleistocene clays are described. Procedures for treating the foundation material, such as placing a sand cushion or flooding the soil are presented. At 1 site 5 to 8 ft of recent loam lay above a 10- to 13-ft clay layer, the top 2 ft being weathered. Ground water was from 50 to 60 ft below the surface and was confined to a sand layer below the clay. The uplift of 6 markers in the brick walls of a waterworks building at the site was observed for 7 yr. Minimum uplift was 0.4 in. and the maximum 5.5 in. Over 90% of the uplift took place in the first 2 yr after the structure was completed. At this location borehole samples showed that water content of the clay, due to leakage from pipelines, increased over 10% to an average value of 38%. Tests indicated that a sand cushion and local flooding resulted in only insignificant uplift compared to that in foundations on untreated bases.

R203144X67A

Sorochan, E A; Burov, E S; Kulachenok, B G

CONSTRUCTION OF STRUCTURES ON SWELLING SOILS WITH PREPARATION OF THE BASE

Soil Mech Found Eng, No 4, pp 281-285, July-Aug 1967. 5 p, 5 fig, 2 ref

DESCRIPTORS-/ *expansive clays/ structures/ uplift pressures/ swelling/ *foundations/ *differential settlement/ cushioning/ deformation/ clays/ building/ structural behavior/ displacements/ moisture content/ foreign design practices

IDENTIFIERS-/ *prewetting/ USSR/ soil-structure interaction

R203145X67A DEFORMATION OF ROCK-FREE SOILS
Assuming a theoretical homogeneous isotropic medium to calculate deformations of soils and the theory of limit equilibrium to estimate bearing capacity describes only part of the total picture of soil behavior under load. These assumptions neglect the nonlinear character of the relation between soil stresses and total stabilized strain tensors and deviators, dilatancy, deformability and other factors of soil strength. Construction of a model to describe rock-free soil is presented. The model covers the prelimit and limit states and also the problem of expansion of a spherical cavity in an unbounded soil mass under internal pressure. The model permits tracing the stress-strain changes and development of regions of limit equilibrium with increase of cavity pressure. Stabilized dilational strains of main types of rock-free soils under static load are noted as being largely irreversible. For most soils the plastic part of dilational strain predominates. These strains, complex stress, the spherical strain tensor and other soil parameters are discussed and relationships presented by 3 graphs and some 23 equations.

R203145X67A

Ioselevich, V A

LAWS OF DEFORMATION OF ROCK-FREE SOILS

Soil Mech Found Eng, No 4, pp 232-237, July-Aug 1967. 6 p, 3 fig, 9 ref

DESCRIPTORS-- / *soils/ *foundations/ structural design/ elastic theory/ elastic deformation/ plastic deformation/ tensile stress/ limit design/ soil tests/ tensor analysis/ rheology/ soil mechanics/ finegrained soils/ stress analysis/ foreign research

IDENTIFIERS--/ dilation/ USSR/ deviator stress

R203219 68A POND SEALING BY CHEMICAL TREATMENT
Over 500 permeability tests with 8 soil-dispersing chemicals were conducted on 9 Tennessee soil types. Sodium pyrophosphate treatments at 2 and sodium carbonate (soda ash) at 5 tons per acre were the most successful. These treatments costing approximately $375 per acre for chemicals reduced the permeability of the 9 soils to from 1/10 to 1/100 of the permeability of identical but untreated samples. Laboratory test results suggest that at least 1 ft of well compacted relatively impervious seal blanket over porous areas of pond floors is necessary to prevent rupture of the seal blanket under 10-ft heads. Nine seriously leaking ponds were treated according to the best procedures developed in the laboratory. Eight of these treated ponds held well; and between January 1 and November 15, 1967, the mean ratio of minimum to maximum pond depths was 0.74. One pond developed serious leaks which were successfully repaired to a pond depth of 6 ft. The field tests substantiated the laboratory tests in that chemical treatments can, for certain situations, be effective in reducing reservoir seepage.

R203219 68A

Sewell, John I

LABORATORY AND FIELD TESTS OF POND SEALING BY CHEMICAL TREATMENT

Water Resour Res Termination Rep, Univ Tenn, May 1968. 79 p, 14 fig, 14 tab, 11 ref, 5 append

University of Tennessee, Knoxville

DESCRIPTORS--/ *permeability/ reservoirs/ lagoons/ *sealing compounds/ ponds/ dispersing agents/ seepage/ sodium compounds/ soil treatment/ *reservoir leakage/ Darcys law/ farm ponds/ water holes/ *soil sealants

IDENTIFIERS--/ *chemical sealants/ *seepage control

R203255 68A WATER-BEARING DEPOSITS IN SUBSIDING AREAS
Land subsidence in extensive areas of the San Joaquin and Santa Clara Valleys, California is causing serious problems in construction and maintenance of costly engineering works such as large canals, water-distribution systems, and drainage and flood-control works. Four core holes in the Los Banos-Kettleman City area, 2 in southern Tulare County and 2 in the Santa Clara Valley, were drilled to obtain samples for determination of physical and hydrologic properties of the subsiding materials. Cores from the holes were analyzed for particle-size distribution, permeability, specific gravity, dry unit weight, porosity, Atterberg limits, consolidation, acid solubility, and gypsum content. Laboratory data in tabular and graphic form are presented, laboratory analysis methods are described, and interrelationships of some of the physical and hydrologic properties are shown. Reference data required for future interpretive reports on subsidence research are furnished.

R203255 68A

Johnson, A I; Moston, R P; Morris, D A

PHYSICAL AND HYDROLOGIC PROPERTIES OF WATER-BEARING DEPOSITS IN SUBSIDING AREAS IN CENTRAL CALIFORNIA

Geol Surv Prof Pap 497-A, pp A1-A71, 1968. 71 p, 24 fig, 10 tab, 46 ref

Geological Survey, California

DESCRIPTORS--/ *aquifers/ sedimentation/ *sediments/ *land subsidence/ clays/ silts/ *soil physical properties/ artesian water/ permeability/ Atterberg limits/ porosity/ specific gravity/ shrinkage/ particle size/ artesian pressures/ moisture content/ solubility/ *subsidence/ canal construction/ void ratio/ California
IDENTIFIERS--/ Santa Clara Valley, Calif/ Tulare County, Calif

R203256 67A STATIC BEHAVIOR OF SOILS
The stability of earth structures subject to hydrostatic and seepage forces is primarily dependent upon the shear strength of the materials of the embankment and foundation. Whether these materials are natural deposits of soils or manmade fills, the shear strengths are invariably anisotropic. Experimental procedures were devised to preserve the anisotropic nature of the soil and to determine its highly directional strength parameters. Using an anisotropic varved silt, the shear strength and pore pressure characteristics were found to be profoundly affected by principal stress, failure plane, and strata orientation. As expected, the angle of internal friction, was greatest and least for samples sheared normal and parallel to the strata. Based on an empirical relationship between soil strength and principal stress, stratification and failure plane directions, a general method of stability analysis has been developed for inherently anisotropic soils.

R203256 67A

Nacci, V A

STATIC BEHAVIOR OF SOILS

Pap, Civ and Ocean Eng, Univ Rhode Island, 1967. 22 p, 20 fig, 3 tab, 14 ref

University of Rhode Island, Kingston

DESCRIPTORS--/ *anisotropy/ shear planes/ *shear stress/ shear tests/ shear strength/ pore pressures/ strain/ stability analysis/ earth dams/ soil physical properties/ static tests/ silts/ kaolin/ triaxial shear/ mohr failure theory/ overconsolidation/ moisture content/ direct shear/ residual stress/ soil mechanics/ slope stability/ slip-circle method
IDENTIFIERS--/ Bishops method

R203258 67A MEASURING SOIL MOISTURE WITH RADIO WAVES
Experimental data were obtained for the field strength of 3 AM radio stations and 1 FM station and for the corresponding moisture content of the soil at various depths and locations between the radio stations and the field strength meter. The relationship between field strength and soil moisture content was investigated. The 2 AM stations which were located farthest away, 71 and 130 mi, showed the most promising relationship between field strength and soil moisture content. The moisture content at 3 ft appeared to have a much greater influence on the field intensity of these stations than surface moisture. The AM station located 25 mi away and the FM station 22 mi away showed much less relationship between soil moisture and field strength.

R203258 67A

Eagleman, Joe R and Moore, Richard K

INTEGRATED SOIL MOISTURE MEASUREMENT USING RADIO WAVES

Kansas Water Resour Res Inst Proj Completion Rep, Univ Kansas, 1967. 62 p, 17 fig, 7 tab, 7 ref, 5 append

University of Kansas, Manhattan

DESCRIPTORS--/ *soil moisture/ moisture content/ *radio waves/ radio reception/ wave length/ test procedures/ soils/ wavelengths/ conductivity

IDENTIFIERS--

STRUCTURAL AND ARCHITECTURAL ENGINEERING

R203036X68A OPTIMUM DESIGN USING AVAILABLE SECTIONS
Conventional optimum structural design methods assume that a continuous spectrum of member sizes is available to the designer. For example, in the minimum-weight rigid-plastic design of stiff-jointed frameworks, the weight per unit length of frame members is assumed to be a linear function of their full plastic moment. Actually, the sections available consist of a finite range of discrete member sizes. By making use of discrete programming techniques, design methods may be derived that are not dependent on theoretical weight-strength functions, but work directly with the available discrete sections. Two classes of design problems are considered: (1) the design of stiff-jointed frameworks using rigid-plastic theory; and (2) the elastic design of statically determinate triangulated frameworks subject to deflection constraints. Has 20 references.

R203036X68A

Toakley, A Raymond

OPTIMUM DESIGN USING AVAILABLE SECTIONS

Proc Amer Soc Civil Eng, J Struct Div, Vol 94, No ST5, pp 1219-1241, May 1968. 23 p, 8 fig, 6 tab, 20 ref, 2 append

Commonwealth Department of Works, Melbourne, Australia

DESCRIPTORS--/ *optimum design/ *structural design/ structures/ frames/ structural analysis/ structural members/ structural engineering/ trusses/ bridge design/ bibliographies/ deflection/ *rigid frames/ weight/ foreign design practices/ plasticity

IDENTIFIERS-- / Monte Carlo method/ *space frames/ Gomory's algorithm/ *rigid structures/ Australia

WATER-PLANT-SOIL RELATIONS

R203073X68A PAN EVAPORATION AND EVAPOTRANSPIRATION
Pan evaporation data are useful for estimating losses from reservoirs and lakes, and for estimating evapotranspiration from agricultural crops using procedures relating evapotranspiration to pan evaporation. Researchers at Utah State University developed a formula for estimating pan evaporation from extraterrestrial radiation and climatic data. This dimensionally sound formula utilizes the climatic data most readily available, and should provide reliable estimates of pan evaporation for a wide range of climatic conditions and latitudes. Tables are presented to simplify application of the formula when electronic computers are not used. Three formulas are included for estimating evapotranspiration for several agricultural crops, using as the principal parameters either extraterrestrial radiation, pan evaporation, or measured incident radiation with the climatic data. These formulas were developed from limited data and may not be reliable for a wide range of climatic conditions and latitudes. Has 20 references.

R203073X68A

Christiansen, Jerald E

PAN EVAPORATION AND EVAPOTRANSPIRATION FROM CLIMATIC DATA

Proc Amer Soc Civil Eng, J Irrig Drainage Div, Vol 94, No IR2, pp 243-265, June 1968. 23 p, 13 tab, 20 ref, append

Utah State University, Logan

DESCRIPTORS--/ *evaporation/ *evapotranspiration/ estimating/ weather/ climatology/ meteorological data/ solar radiation/ cloud cover/ crops/ wind speed/ consumptive use (water)/ irrigation/ *water requirements/ humidity/ temperature/ bibliographies

IDENTIFIERS--/ *evaporation pans/ elevation/ evaporation coefficient

R203094X68A WATER RELEASE AS A SOIL PROPERTY
The volume fraction of soil water released to growing plants is proposed as a soil property for comparing soils for plant use or for evaluating structural changes in a given soil. A procedure is described for measuring water release as a function of soil suction. An application is illustrated for use with soil containers or field practices. The procedure proposes gravimetrically measuring transpiration water loss from a soil-plant system involving 1 gal of soil. Soil water depleted by root action is measured at arbitrary points during a transient drying cycle as simultaneous readings of soil suction are made, using tensiometers or resistance blocks calibrated to read soil suction above the 1-bar range limit of tensiometers. Examples of water-release curves are given for 3 soils having widely varying textures. Two soils with widely differing textures had nearly identical water-release curves. A sandy- or coarse-textured soil had a favorable water-release characteristic for shallow profiles but would lose 2/3 of the stored water to downward drainage if used in a field profile showing a soil suction of 10 cb in the surface soil following irrigation. One soil subsample was treated with VAMA, causing a marked increase in water release.

R203094X68A

Richards, Sterling J

WATER RELEASE AS A SOIL PROPERTY RELATING TO USE OF WATER BY PLANTS

Trans Amer Soc Agr Eng, Vol 2, No 1, pp 74-77, Jan-Feb 1968. 3 p, 4 fig, 1 tab, 5 ref

University of California, Riverside

DESCRIPTORS--/ soils/ soil science/ *agronomy/ evapotranspiration/ soil physics/ tensiometers/ soil profiles/ *plant (botany)/ soil texture/ agriculture/ grasses/ soil physical properties/ *soil moisture/ moisture content/ soil tests/ test procedures

IDENTIFIERS--/ moisture uptake/ *soil-water-plant relations/ *soil water storage/ soil suction/ *water retention/ *soil moisture movement

R203118X67A TRANSPIROMETER TO MEASURE TRANSPIRATION
This study compares transpiration results using the electronic hygrometer and quick weighing methods. It determined that quick weighing results from several species compare closely to hygrometer data in direction. The study describes the water loss from greasewood (Sarcobatus vermiculatus) branches differing in condition and from saltgrass (Distichlis stricta) where separate clumps were studied. The dark green leaves of greasewood appear to be better able to control water loss than the yellow-green leaves. The study follows the curves for water loss during flowering and fruiting of sagebrush (Artemisia tridentata) and rabbitbrush (Chrysothamnus nauseosus albicaulis) using the same 10 branches for study over a 2-month period. Both of these latter species appear to be able to control water loss during the period of fruit expansion somewhat independent of air temperatures and relative humidity. Water loss is rapid in rabbitbrush as the fruit accessory tissues dry out.

R203118X67A

Stark, N

THE TRANSPIROMETER FOR MEASURING THE TRANSPIRATION OF DESERT PLANTS

J Hydrol, Vol 5, pp 143-157, 1967. 15 p, 11 fig, 3 ref

University of Nevada, Reno

DESCRIPTORS--/ water requirements/ hygrometry/ plant (botany)/ water loss/ rabbitbush/ *transpiration/ sagebrush/ flowering/ *desert plants

IDENTIFIERS--/ hygrometers

R203120 68A MOISTURE USE BY FRUIT TREES
Soil moisture and trunk growth of young apricot and peach trees were measured under floodwater spreading conditions in the Negev highlands of Israel. Twenty access tubes for a neutron moisture probe were placed in 4 concentric circles around each tree. The moisture measurements were taken to represent the soil moisture in a central cylinder and 3 concentric annuli having soil surface areas of 3.14, 9.42, 15.70, and 10.1 sq m, respectively. Rates of moisture depletion and trunk growth were different for each species and did not appear to be related to soil moisture availability. Young apricot trees produced nearly 3 times the trunk cross-sectional area as peach trees per unit of water depletion. Root distribution of the trees was estimated by interpreting the changes in soil moisture.

R203120 68A

Cohen, O P; Evenari, M; Shanan, L; et al

"RUNOFF FARMING" IN THE DESERT: II. MOISTURE USE BY YOUNG APRICOT AND PEACH TREES

Agron J, Vol 60, No 1, pp 33-38, 1968. 6 p, 5 fig, 1 tab, 12 ref

Volcani Institute Agricultural Research, Rehovot and Hebrew University, Jerusalem, Israel
DESCRIPTORS--/ runoff/ soil moisture/ soil moisture meters/ root development/ root distribution/ peaches/ growing period/ arid climates/ moisture meters/ irrigation/ *fruit crops/ *water spreading/ deserts/ *flood irrigation/ water harvesting

IDENTIFIERS--/ apricots/ Negev, Israel/ *runoff farming/ soil moisture movement

R203128X67A PERIODS OF PLANT GROWTH ESTIMATED FROM CLIMATIC DATA
To gain information on rainfall effectiveness, since it dominates the growth of forage throughout the year, water balance models employing total rainfall and potential evaporation over 5-day intervals were developed to estimate periods or plant growth in arid central Australia. Of 2 basic models developed, 1 expressed a relationship between an empirical measure of growth stage and the ratio of expected evapotranspiration in the absence of water stress to the potential evaporation. The other related the ratio of actual to expected evapotranspiration and the estimated soil water storage, under conditions of restricted soil water supply. A program prepared for the CDC 3600 computer was used to analyze the data. The seasonal rainfall pattern shows a summer maximum; however, the probability of soil water availability was highest in winter. The effectiveness of summer rains is greatly diminished by potential evaporation rates. The seasonal pattern of growth expectancy parallels that for soil water storage; however, at no station does the probability of a growth period commencing in any one month exceed 0.60 and this occurs only in Dec and Jan. The results may be of practical value in suggesting grazing practices in harmony with the basic climatic factors setting the pattern of growth. Has 17 references.

R203128X67A

Fitzpatrick, E O; Slatyer, R O; Krishnan, A I

INCIDENCE AND DURATION OF PERIODS OF PLANT GROWTH IN CENTRAL AUSTRALIA AS ESTIMATED FROM CLIMATIC DATA

Agr Meteorol, Vol 4, No 6, pp 389-404, 1967. 16 p, 9 fig, 2 tab, 17 ref

Commonwealth Scientific and Industrial Organization, Canberra, Australia
DESCRIPTORS--/ water balance/ grazing/ depth-area-duration analysis/ root zone/ range management/ time series analysis/ water storage/ *soil water/ *plant growth/ evapotranspiration/ droughts/ arid climates/ desert plants/ *moisture availability/ model studies/ recharge

IDENTIFIERS--/ Australia/ potential evaporation/ rainfall expectancy

R203130 68A WATER LOSS AND STOMATAL CONTROL IN SORGHUM
Temperature and diffusion resistance of leaves and micrometeorological factors were measured in a well-watered sorghum field in central Arizona during June. Shortwave radiation, soil heat flux, air temperature, air humidity, and wind speed were also measured. Analysis of a typical 24-hour period showed that the stomata regulate transpiration only during the periods of darkness and low light. This was determined from a comparison of the values for the canopy resistance as derived from direct measurement on leaves and as calculated from the environmental data. During the daylight period the sorghum plant acts like a wick. It was predicted that neither an increase in number or aperture of stomata nor a wetting of the entire foliage would increase the evaporative rate. The sorghum foliage was always found to be several degrees cooler than the ambient air, even in the middle of the day. Also the energy equivalent of the evaporative flux exceeded the net radiant flux at all times and by 80% over the 24 hour period.

R203130 68A

van Bavel, C H M and Ehrler, W L

WATER LOSS FROM A SORGHUM FIELD AND STOMATAL CONTROL

Agron J, Vol 60, No 1, pp 84-86, Jan-Feb 1968. 3 p, 2 fig, 1 tab, 9 ref

U S Department of Agriculture and U S Water Conservation Laboratory, Phoenix, Ariz
DESCRIPTORS--/ evaporation/ *transpiration/ canopy/ micrometeorology/ *stomata/ *sorghum

IDENTIFIERS--/ plant physiology

R203135X67A SOIL MOISTURE IN GREASEWOOD AND SAGEBRUSH STANDS
Soil moisture measurements were made over a 2-year period in adjacent greasewood (Sarcobatus vermiculatus) and sagebrush (Artemisia tridentata) stands in the desert steppe region of southeastern Washington. Soil moisture was determined gravimetrically by twice-weekly weighings of buried, soil-filled cans arranged in open spaces between shrub clumps. Soil moisture accumulated during fall and winter. On March 19 the upper 4 dm of soil in the greasewood stand averaged 14.8% moisture as compared to 10% for sagebrush soil. The greater accumulation of moisture in the greasewood stand appeared to be the result of decreased evaporation losses and the lack of transpiration from shrub species which are leafless during winter and early spring. The average density of cheatgrass plants on the greasewood site was 47 plants/sq dm (n=24) as compared to 1.4 plants/sq dm (n=36) in the sagebrush site. The more luxuriant growth of cheatgrass in the greasewood stand was related to winter and spring retention of soil moisture.

R203135X67A

Rickard, W H

SEASONAL SOIL MOISTURE PATTERNS IN ADJACENT GREASEWOOD AND SAGEBRUSH STANDS

Ecology, Vol 48, No 6, pp 1034-1038, 1967. 5 p, 4 fig, 2 tab, 3 ref

Battelle Memorial Institute, Pacific Northwest Laboratory, Richland, Wash
DESCRIPTORS--/ *soil moisture/ evaporation/ plant (botany)/ field tests/ vegetation/ vegetation effects/ *sagebrush/ transpiration/ bromegrass/ desert plants/ moisture availability/ brush/ seasonal/ Washington

IDENTIFIERS--/ *greasewood

R203009 67A ECOLOGY OF FARM PONDS IN SOUTHWESTERN USA
Water quality in farm ponds of the southwestern plains is often impai: by high turbidity due to suspension of colloidal clay. The reason for this turbidity in certain ponds but not in others was investigated as well as ecological consequences of turbidity. Pond morphometry and chemical characteristics of the water of 29 farm ponds were related to turbidity on a seasonal basis. Clarity of pond water was positively correlated with mean depth, pH, dissolved solids, and conductivity. Shallow ponds with large surface areas tended to be turbid. In selecting pond sites (or in improvement of existing ones), (1) the pond area should be small relative to pond volume; the mean depth great; (2) erosion and siltation should be prevented (possibly by settling basins); (3) roiling of the water by cattle discouraged; (4) gypsum or lime added to increase the pH, dissolved solids, and conductivity. Seasonal pigment diversity of 29 farm ponds was lower in turbid ponds than in clear ones suggesting an ecological consequence of turbidity, i.e.; phytoplankton populations in turbid ponds are always in the initial stages of algal succession. Clear ponds appear to be more suitable for fish production. Has 23 references.

R203009 67A

Toetz, Dale W

ECOLOGICAL FACTORS AFFECTING TURBIDITY AND PRODUCTIVITY IN PRAIRIE PONDS IN THE SOUTHERN GREAT PLAINS

Res Project Tech Completion Rep, Water Resources Res Inst, Oklahoma State Univ, Aug 1967. 34 p, 11 tab, 23 ref

Oklahoma State University, Stillwater

DESCRIPTORS--/ turbidity/ *ponds/ fish/ ecology/ *water quality/ suspended solids/ pH/ wind (meteorology)/ rainfall/ limnology/ surface water/ farm ponds/ conductivity/ colloids

IDENTIFIERS--/ productivity/ small impoundments/ Southwestern USA/ nitrification

R203010 67A SELECTED PAPERS ON WATER POLLUTION
This book of selected publications on biology of water pollution, water treatment and sewage and industrial waste treatment contains some of the many excellent and basic pertinent biological papers that have been commonly inaccessible to the contemporary investigator. These papers are often quoted and are a portion of the foundation upon which modern aquatic ecological scientific thought and decisions are often based in summating water pollution control investigations. This compiled collection will be of assistance in 3 phases of water pollution abatement: (1) it will provide a technical service to the aquatic ecologist through assemblage of informative literature; (2) it will illustrate many of the concepts upon which regulations have been formulated for the protection of aquatic life; and (3) it will aid in the training of new environmental scientists to meet today's and tomorrow's personnel needs in the conservation of our nation's natural resources. Has 530 references.

R203010 67A

Keup, Lowell E; Ingram, William M; Mackenthun, Kenneth M

BIOLOGY OF WATER POLLUTION: A COLLECTION OF SELECTED PAPERS ON STREAM POLLUTION, WASTE WATER, AND WATER TREATMENT

Fed Water Pollut Contr Admin Publ CWA-3, 1967. 290 p, 107 fig, 58 tab, 2 photo, 530 ref

Federal Water Pollution Control Administration, Washington, D C

DESCRIPTORS--/ *water pollution/ waste disposal/ *sewage treatment/ fish conservation/ pollution abatement/ bibliographies/ ecology/ biology/ fish/ plankton/ water quality/ algae/ aquatic life/ stream pollution/ bacteria/ impurities/ *waste water treatment/ *waste water disposal/ waste treatment/ *industrial wastes/ *water pollution control
IDENTIFIERS--

R203012 67A STRUCTURE OF THE DIATOM COMMUNITY
In the present study 3 series of experiments were performed. One was to show the effect of the size of area and the number of species in the species pool which were capable of invading an isolated area on the number of species composing the diatom community. The second series of experiments was to show the effect of altering the invasion rate on the structure of the community. The third series of experiments was a comparison of the structure of diatom communities in structurally and chemically similar streams on the island of Dominica and in the United States. The temperature of the water in the 2 rivers was similar when the studies were made.

R203012 67A

Patrick, Ruth

THE EFFECT OF INVASION RATE, SPECIES POOL, AND SIZE OF AREA ON THE STRUCTURE OF THE DIATOM COMMUNITY

Proc Nat Acad Sci, Vol 58, No 4, pp 1335-1342, Oct 1967. 8 p, 1 tab, 7 fig

Academy of Natural Sciences, Philadelphia, Pa

DESCRIPTORS-- / environmental effects/ competition/ distribution/ aquatic life/ microorganisms/ distribution patterns/ *biological communities/ spatial distribution/ dominant organisms/ *diatoms/ invasion/ ecological distribution

IDENTIFIERS--

R203017 66A URBAN STORM WATER RUNOFF
This report is a compilation of selected abstracts pertinent to the problem of urban drainage. This bibliography is selective; for instance, papers describing a sewerage system and making only passing reference to some storm-water aspects were not included. Also no attempt was made to use references from textbooks which may have a few pages to a whole chapter devoted to stormwater runoff. The abstracting and indexing journals were used extensively in compiling the bibliography. However, other papers, published or unpublished, were abstracted and are included. Also included are a number of references compiled by Region II, Public Health Service, Division of Water Supply and Pollution Control, in February 1961, on the storm-water overflow problem. Many of the references are from foreign publications. References were divided into several broad categories and under each major topic the title of the paper is listed. It is felt that the title should give some indication of the subject matter and that this general subject index along with an author's index will make the bibliography more useful. Has 287 references.

R203017 66A

Anderson, Richard J; Evans, Francis L; Weibel, Samuel R

STORM WATER RUNOFF FROM URBAN AREAS: SELECTED ABSTRACTS OF RELATED TOPICS

Federal Water Pollut Contr Admin Rep, Washington, D C, April 1966. 98 p, 287 ref

Federal Water Pollution Control Administration, Cincinnati, Ohio

DESCRIPTORS-- / bibliographies/ runoff/ *storms/ *cities/ abstracts/ *rainfall/ *urban areas/ *surface runoff/ water treatment/ drainage/ instrumentation/ sewers/ water quality/ water pollution/ storm drains/ pollution abatement/ discharge measurement/ *storm runoff/ overflow

IDENTIFIERS--/ *urban drainage/ *urban hydrology

R203018 68A AQUATIC COMMUNITIES IN WATER RESEARCH
The maintenance of the aquatic environment of man in a healthy or natural condition is dependent upon the correct functioning of the aquatic ecosystem. This is necessary if we are to have multipurpose uses of our surface waters. With man's increased use of water, surface waters are becoming more and more polluted and will ultimately be destroyed. If man is to have multipurpose use of waterways, he must know how to manage them correctly. To do this he must understand how aquatic ecosystems function and how perturbation affects them. What is known about the structure and functioning of aquatic ecosystems is set forth along with how nutrients and energy are cycled through them. Our knowledge of effects of various types of pollution on these ecosystems is discussed. Those fields of research are indicated which need to be pursued to understand the structure and functioning of aquatic ecosystems. The kinds of basic studies needed to understand the effects of various types of pollution or perturbation are discussed along with how they can be diagnosed. Ways are suggested how research in this important field should be implemented.

R203018 68A

Patrick, Ruth

WATER RESEARCH PROGRAMS--AQUATIC COMMUNITIES

Office Water Resources Res Rep, Mar 1968. 22 p, 9 ref

Academy of Natural Sciences of Philadelphia, Pa

DESCRIPTORS--/ *ecology/ *aquatic life/ environment/ water pollution/ sea water/ fresh water/ brackish water/ stream pollution/ bacteria/ wastes/ fish/ invertebrates/ algae/ lakes/ streams/ pollution abatement/ energy transfer/ *ecosystems/ *biological communities/ food chains/ protozoa/ potable water/ *aquatic environment/ *water pollution effects/ nutrients
IDENTIFIERS-- / perturbation

R203019 67A WASTE TREATMENT IN PAPER MANUFACTURING
This industrial wastewater profile covers the paper industry and integrated pump and papermills in the United States as defined by Standard Industrial Classification 2621 (except building) of the Department of Commerce. The principal areas of discussion are: (1) the fundamental manufacturing processes and significant water and gaseous wastes generated by each operation; (2) process water use and reuse; (3) waste quantities and characteristics; (4) waste reduction practices (including both waste treatment and in-plant processing) and their effectiveness; and (5) waste treatment costs. Projections or estimates have been made for the changes, developments, and operating practices that will be prevalent in 1977 for each area of discussion. Has 130 references.

R203019 67A

Anon

COST OF CLEAN WATER: INDUSTRIAL WASTE PROFILE NO 3, PAPER MILLS, EXCEPT BUILDING

Federal Water Pollut Contr Admin Publication IWP-3, Nov 1967. 65 p, 9 tab, 130 ref, 4 append

Federal Water Pollution Control Administration, Washington, D C

DESCRIPTORS--/ *waste disposal/ industrial plants/ costs/ water reuse/ economics/ bibliographies/ water pollution/ *pollution abatement/ waste water/ wastes/ water treatment/ water quality/ *waste water treatment/ *pulp wastes/ *wood wastes/ *pulp and paper industry/ *waste treatment/ saw mills/ *treatment facilities/ byproducts/ industrial wastes
IDENTIFIERS--

R203022 67A INDUSTRIAL WATER POLLUTION CONTROL POLICY
This study is an examination of alternative possible approaches for providing incentives to industry to comply with pollution abatement standards being created under the Water Quality Act of 1965 and the Clean Water Act of 1966. The study is limited to the manufacturing industry, although there are significant water pollution problems associated with aspects of mining and agriculture as well. The primary focus of the technological analysis is on problems of organic and inorganic wastes, rather than thermal pollution. However, these other areas and problems are of vital interest to the nation's clean water program and some of the arguments developed in this report are applicable to other aspects of pollution as well. Among industrial incentives, it proved impossible to limit consideration to only a few obvious alternatives. In addition to more straight-forward devices like tax incentives, grants, and loans, less direct approaches were also examined, most notably the creation of treatment authorities for a whole area, river basin, or the part of such a basin within a single state. It became necessary to examine the problem of possible hardship cases, and adequacy of existing men and materials to operate expanded facilities. Has 84 references.

R203022 67A

Anon

INCENTIVES TO INDUSTRY FOR WATER POLLUTION CONTROL: POLICY CONSIDERATIONS

Federal Water Pollut Contr Admin Rep, Dec 1967. 119 p, 84 ref

ABT Associates, Inc, Cambridge, Mass

DESCRIPTORS--/ costs/ *industries/ water quality/ *water pollution control/ *pollution abatement/ economics/ benefits/ standards/ water quality act/ waste disposal/ wastes/ effluents/ water pollution/ cost-benefit ratio/ water treatment/ stream pollution/ *industrial wastes/ incentives/ water quality control/ financing/ grants/ *treatment facilities/
IDENTIFIERS--

R203028 67A SANTEE RECREATION PROJECT
This report presents the results of a study of Santee, California recreational lakes. The Santee lakes were planned to utilize the community's reclaimed sewage effluent. By the summer of 1965, a special basin adjacent to one of the lakes was supplied with reclaimed water and used for swimming. This was found possible after progressive use of the lakes for boating and then for fishing. The 7-agency cooperative study evaluated the fate of virus, total and fecal coliform, and fecal streptococci as waste water passed through conventional secondary treatment processes, sand filtration, and recreational lakes. Correlative physical, chemical, and biological data have also been obtained by study of the lakes and related land area. Observations related to eutrophication, vector control, epidemiology, and social acceptance and ecology of the entire recreational park were also obtained. Additional treatment provided by intermittent sand filtration met most of the requirements for recreational use of the terminal ponds. No health hazards have been demonstrated by the viral or other findings, and this fact had considerable impact in the promotion of public acceptance and use of the recreational facilities. Has 24 references.

R203028 67A

Merrell, John C Jr; Jopling, William F; Bott, Roderick F; et al

SANTEE RECREATION PROJECT, SANTEE, CALIFORNIA, FINAL REPORT

Fed Water Pollut Contr Admin Rep WP-20-7, Cincinnati, Ohio, 1967. 165 p, 35 fig, 1 plate, 33 tab, 24 ref, 21 append

California Department of Public Health; San Diego Department of Public Health, Calif
DESCRIPTORS--/ multiple purpose projects/ *water reuse/ *recreation/ ecology/ lakes/ water utilization/ viruses/ water treatment/ *sewage treatment/ effluents/ bacteria/ biology/ water quality/ waste water/ fish/ reclaimed water/ eutrophication/ California/ *waste water treatment/ coliforms
IDENTIFIERS--/ virology/ Santee Rec Proj, Calif/ Santee, Calif

R203030 67A OPINION SURVEY ON WATER POLLUTION CONTROL
This report is a survey of community leader attitudes on the water pollution problem in the Massachusetts municipalities of Springfield, Chicopee, and South Hadley. An unofficial, anonymous group of 12 individuals chosen in each community was made up of 2 representatives each from the institutional sectors of business and industry, labor, community relations, politics and government, education, and communications. These community leaders agreed on the importance of the pollution problem and the need for a cooperative regional approach. They also agreed that the regional problem had not been alleviated, and that Federal and state authorities had not been active enough in abatement work. They differed in respect to the priority they placed on the problem as compared to other environmental problems in the respective municipalities and in the metropolitan area. Further studies should be made using a wider spectrum of communities in several regions to evaluate the relationship between community leader attitudes and the community's socio-economic profile including the following factors: educational level, age composition, percentage of foreign born, occupational groupings, and mean annual income.

R203030 67A

Shanley, Robert A

A SURVEY OF COMMUNITY LEADER ATTITUDES ON WATER POLLUTION ABATEMENT IN SELECTED MASSACHUSETTS COMMUNITIES ON THE CONNECTICUT RIVER

Bur of Government Res Rep, Univ Massachusetts, Oct 1967. 32 p, 2 tab, 13 ref, 2 append

University of Massachusetts, Amherst

DESCRIPTORS--/ *water pollution/ *pollution abatement/ programs/ *public opinion/ public relations/ public works/ municipalities/ cities/ states (geographical)/ personnel/ leadership

IDENTIFIERS--/ *water pollution control/ Massachusetts/ *surveys (data collection)/ Federal agencies

R203041X68A EUTROPHICATION OF WATER
Symptoms of eutrophication, evaluation of its degree, and problems associated with inorganic enrichment are described. When considering remedial measures such as removing nitrogen and phosphorus from sewage effluents, the sources of nutrients to the system must be established and the likelihood that the proposed measures would prevent development of nuisance conditions or restore some amenity use of water that was lost must be evaluated. Increased use of detergents and increased amounts of fertilizers applied to land have contributed to increased nitrogen and phosphorus contents of river water. Indirect evidence suggests that 50% of the phosphorus in sewage effluents is derived from detergents. Amounts of nitrogenous fertilizers applied to agricultural land in Britain have doubled in 10 yr and land drainage has contributed much inorganic nitrogen to rivers. A nutrient balance sheet for a reach of the Great Ouse River is described. This balance sheet indicates that sewage effluents contribute a small proportion of nitrogen, silicon, chloride, and sulfate to this river, whereas the bulk of the phosphorus could be attributed to that discharged in effluents. Has 17 references.

R203041X68A

Owens, Morlais and Wood, Gavin

SOME ASPECTS OF THE EUTROPHICATION OF WATER

Water Res, Vol 2, No 2, pp 151-159, Feb 1968. 9 p, 3 fig, 2 tab, 17 ref

Water Pollution Research Laboratory, Stevenage, Great Britain

DESCRIPTORS--/ fertilizers/ *sewage effluents/ bibliographies/ *water pollution/ algae/ nitrogen/ oxygen content/ organic compounds/ *water treatment/ agriculture/ costs/ recreation/ economics/ water supplies/ reservoirs/ lakes/ phosphates/ phosphorus/ *water quality/ waste water

IDENTIFIERS--/ *eutrophication/ inorganic compounds/ nutrients/ foreign research/ domestic water/ detergents/ Great Britain

R203069X68A MANMADE CONTAMINATION HAZARDS
Ground-water hazards may result from adding wastes to water infiltrating the soil, or to soil through which water percolates. Contaminants include human, industrial, and commercial wastes; and those associated with use of water, fertilizers, and pesticides in agriculture. Experimental data indicate that particulate matter, including bacteria and viruses, does not move far with percolating water in the soil. Chemical products of biodegradation move freely and reach ground water. Since biodegradation products of organic wastes are the same as natural contribution of organic matter to the soil, the effect of domestic water use generally is to increase concentration of dissolved ions normally present in ground water. Hazards of ground-water contamination from industry consist of metal ions, phenols, tar residues, brines and exotic organics. Hazards from agriculture are pesticide residues and mineralization with nutrients and soluble soil fractions. Leaching from solid-waste land fills is possible with poor long-term management and might involve chemicals, iron, and various earth minerals. The most serious hazard results from buildup of dissolved solids to levels inimical to beneficial use.

R203069X68A

McGauhey, P H

MANMADE CONTAMINATION HAZARDS

Ground Water, Vol 6, No 3, pp 10-13, May-June 1968. 4 p, 4 ref

University of California, Berkeley

DESCRIPTORS--/ *water pollution/ *ground water/ waste water/ *wastes/ *waste disposal/ pesticides/ hazards/ organic compounds/ fertilizers/ leaching/ sewage/ sewage effluents/ viruses/ bacteria/ *contamination/ return flow/ garbage

IDENTIFIERS--/ *dissolved solids/ industrial wastes/ municipal wastes/ *biodegradation/ brines

R203075X68A NEED FOR NUTRIENT CONTROL
Nutrient control is needed to arrest eutrophication of lakes and streams. Cultural drainage is a major nutrient contributor and a logical point of attack on the problem. Soil erosion control and prevention of leaching from animal manures are helpful agricultural practices. Phosphorus removal is the most promising solution for eutrophication control, since some blue-green algae can fix nitrogen; other nutrients are present in natural waters or exist in quantities too minute for practical removal. Chemical analysis of lake water at frequent intervals can determine the nutrients that decline in concentration as primary productivity increases.

R203075X68A

Sawyer, Clair N

THE NEED FOR NUTRIENT CONTROL

J Water Pollut Contr Fed, Vol 40, No 3, pp 363-370, Mar 1968. 8 p, 5 fig, 1 tab, 11 ref

Metcalf and Eddy, Boston, Mass

DESCRIPTORS--/ *limnology/ lakes/ reservoirs/ streams/ contamination/ nitrogen/ phosphorus/ water analysis/ *water pollution/ water quality/ algae/ *pollution abatement/ control/ aquatic life/ dissolved oxygen/ surface runoff/ agriculture/ waste water

IDENTIFIERS--/ *eutrophication/ farms/ *nutrients

R203076X68A AERIAL INFRARED POLLUTION SURVEILLANCE

Airborne infrared imagery provides a mapping system for rapid surveillance and monitoring of thermal, organic, and inorganic pollution. Infrared systems, operating in the 8- to 14-micron portion of the electromagnetic spectrum, measure water-surface temperatures. Specific applications include: (1) determining in waterbodies thermal circulation and diffusion patterns produced by coolant discharge from powerplants; (2) assisting development of a thermal pollution index; (3) detecting thermal pollution and measuring river temperature downstream from discharges of heated water; and (4) establishing natural diurnal and seasonal ranges of water-surface temperatures. Water pollutants can be determined from temperature-independent emission and absorption properties. One approach involves spectrally characterizing materials by recording energy levels within narrow 1- to 2-micron bands across the 4- to 14-micron portion of the spectrum, and using the narrow-band multiple-spectrum curves for identifying pollutants.

R203076X68A

Van Lopik, J R; Rambie, G S; Pressman, A E

POLLUTION SURVEILLANCE BY NONCONTACT INFRARED TECHNIQUES

J Water Pollut Contr Fed, Vol 40, No 3, pp 425-438, Mar 1968. 14 p, 14 fig, 10 ref

Texas Instruments Inc, Dallas

DESCRIPTORS--/ *water pollution/ thermal properties/ *infrared rays/ spectrum analysis/ mapping/ *reconnaissance surveys/ *thermal radiation/ emissivity/ cooling water/ contamination/ physical properties/ sensors/ radiation measurement/ measuring instruments/ wave length/ aerial photography
IDENTIFIERS--/ *infrared imagery/ airborne surveying/ isotherms/ *aerial reconnaissance/ *thermal pollution/ surface temperature/ radiometry

R203083 68A MAXIMUM ACROLEIN CONTENT FOR RESERVOIRS

Experimental data were analyzed to determine the possible toxic effect of acrolein in reservoirs containing drinking water. A study was made of the stability of acrolein in water and influences on biochemical oxygen consumption. Experiments were conducted on effects of acrolein on development and extinction of saprophytic microflora. Albino rats were examined for physiological effects. The restrictive index of acrolein toxicity is its influence on the processes of natural self-purification. A concentration of 0.01 mg/kg of body weight is recommended as the threshold dosage. When water contains 0.01 mg/l of acrolein, the daily human intake of drinking water will constitute 0.0005 mg/kg of body weight. Prolonged access of this dosage into the organism evidentally is not dangerous from the standpoint of sanitation and toxicology.

R203083 68A

Goeva, O E

MAXIMUM PERMISSIBLE ACROLEIN CONTENT IN RESERVOIRS

Leningrad Sanitar-Gig Med Inst, Vol 81, pp 58-63, 1965. Transl from Russ, Joint Publ Res Serv Transl 733, June 1968. 6 p, 2 fig

DESCRIPTORS--/ reservoirs/ *water pollution/ municipal water/ cultures/ water supplies/ contamination/ *toxicity/ *herbicides/ microorganisms/ dosage/ biochemical oxygen demand/ aldehydes/ safety/ sanitation/ health

IDENTIFIERS--/ *acrolein/ potable water/ animal physiology

R203091X68A WASTEWATER REUSE
Water, man's most essential mineral, is used, reused, and used again. Water reuse estimates by U S cities show that 1/2 of the average surface supplies has passed through a municipal or industrial outfall. A single municipal water use contributes 50 mg/l of organic contaminants and 300-400 mg/l of dissolved organic materials after primary and secondary waste treatment. Conventional waste treatment is not designed to remove nutrients, inorganic salts, or nonbiodegradable organics; new advanced waste treatment processes are being designed to alleviate pollution by these contaminants and will renovate waste water into a usable product. Plans for deliberate water reuse are being developed in the U S, South Africa, England, Belgium, Japan, Mexico, the Bahamas, Chile, and Israel. A summary presents advanced waste treatment development in the U S according to treatment process, plant size, location, projected costs, and Federal Water Pollution Control Administration research and development grants.

R203091X68A

Stephan, David G and Weinberger, Leon W

WASTEWATER REUSE--HAS IT "ARRIVED"

J Water Pollut Contr Fed, Vol 40, No 4, pp 529-539, Apr 1968. 11 p, 1 fig, 5 tab, 3 ref

Federal Water Pollution Control Administration, Washington, D C

DESCRIPTORS--/ *waste water/ *water treatment/ water supplies/ *sewage treatment/ *water reuse/ water utilization/ water pollution/ pollution abatement/ sewage effluents/ sanitary engineering/ water quality/ water costs/ organic compounds/ municipal water/ foreign countries/ costs

IDENTIFIERS--/ dissolved solids/ *advanced waste treatment/ *waste water treatment/ *waste water use

R203092X68A CONTAMINANTS FROM STABILIZATION PONDS
Contaminants were measured in ground water near 10 ponds used for stabilizing raw waste water from small municipalities. The purpose was to establish concentration levels and travel distances of contaminants from ponds having relatively high infiltration rates, and to observe transformations of the contaminants in the ground water. Results can be used for determining safe distances between a stabilization pond and a shallow ground-water supply in sandy or silty soil. Constituents traced were ammonia, nitrogen, nitrites, nitrates, phosphates, and alkyl benzene sulfonate. Nitrogen was found mainly in the form of ammonia nitrogen and was reduced to background levels after 300 ft of underground flow. The data showed that: (1) Time is important in the travel of all contaminants. (2) Nitrate contamination of shallow ground water was apparently not a threat in the immediate vicinity of ponds studied; low nitrate concentration was apparently due to algal consumption of nitrates and ammonia nitrogen. (3) Phosphates were not found in significant concentrations, due to algal consumption and soil adsorption. (4) Alkyl benzene sulfonate was found in significant concentrations 200 ft from the ponds.

R203092X68A

Preul, Herbert C

CONTAMINANTS IN GROUNDWATERS NEAR WASTE STABILIZATION PONDS

J Water Pollut Contr Fed, Vol 40, No 4, pp 659-669, Apr 1968. 11 p, 7 fig, 2 tab, 13 ref

University of Cincinnati, Ohio

DESCRIPTORS--/ waste disposal/ waste water/ *water pollution/ *sewage effluents/ water quality/ water supplies/ water treatment/ percolation/ *ground water/ *contamination/ infiltration/ sewage disposal/ nitrogen/ sewage treatment/ nitrates/ phosphates/ sanitary engineering

IDENTIFIERS--/ nitrites/ ammonia/ ABS/ municipal wastes/ *oxidation lagoons/ sewage stabilization

R203109 68A SULFIDE TO SULFATE REACTION STUDIES
For the past several years, a fundamental study of the sulfide to sulfate reaction, relative to acid mine drainage chemistry, has been in progress at Ohio State University. This paper is a report on a limited area of this study, and is principally concerned with those investigations designed to point out the important physical and chemical parameters related to the kinetics of the sulfide to sulfate reaction. More speculation is presented than conclusions drawn. However, a number of general facts are listed and the effect of several important variables are described. Experimental observations for 2 types of pyrite oxidation, (1) aerobic and (2) ferric ion (anaerobic) are presented. These data are then interpreted and a mechanism suggested to explain the observed kinetics. This study was financed by Federal Water Pollution Control Administration Research Grant No. WP-00340.

R203109 68A

Smith, E E; Svanks, K; Shumate, K

SULFIDE TO SULFATE REACTION STUDIES

Pap, Ohio State Univ, 1968. 10 p, 5 fig, 4 tab, 12 ref

Ohio State University, Columbus

DESCRIPTORS--/ *sulfates/ kinetics/ *oxidation/ pyrites/ oxygen content/ decomposition/ ions/ pH/ *sulfides/ *chemical reactions/ mine drainage/ *acid mine water/ microbiology

IDENTIFIERS--/ hydrogen ion concentration/ *aerobic treatment/ aerobic bacteria

R203110 67A BIOLOGY OF FRESH-WATER ENVIRONMENTS
The authors of this book have used "Limnological Aspects of Recreational Lakes," Public Health Service Publication No 1167, (now out of print), by Mackenthun, Ingram, and Porges, as a base to expand the consideration and treatment of aquatic biota and aquatic environment. The present work is not a second edition. Rather, it discusses the identification, investigation, and control of problems associated with the biota in flowing streams, lakes reservoirs, and ponds. First introduced are the biological problems associated with fresh-water environments, reviews and gives examples of water uses, and cites briefly the history of Federal legislation governing water pollution and the Federal role in coping with it. The effects on the aquatic environment of temperature, dissolved oxygen, and light are considered, as are effects of streams on reservoirs and reservoirs on streams. The responses of algae, vascular plants, benthos, and fish to aquatic environment under various influencing forces are itemized. Some problems associated with defining the aquatic environment are discussed. The why, what, how, where, and when of lake and stream data collecting and reporting are delineated. Water associated pests are discussed. Has 569 references.

R203110 67A

Mackenthun, Kenneth M and Ingram, William M

BIOLOGICAL ASSOCIATED PROBLEMS IN FRESHWATER ENVIRONMENTS

Fed Water Pollut Contr Admin Rep, July 1967. 287 p, 23 fig, 60 plate, 11 tab, 569 ref

Federal Water Pollution Control Administration, Cincinatti, Ohio

DESCRIPTORS--/ *aquatic life/ herbicides/ algae/ environment/ biology/ bibliographies/ fresh water/ weeds/ weed control/ insects/ biological treatment/ lakes/ limnology/ *aquatic plants/ aquatic algae/ nutrients/ *aquatic animals/ aquatic weed control/ algal control/ eutrophication/ slimes/ *aquatic environment/ aquatic productivity/ aquatic insects
IDENTIFIERS--

R203229 68A PORTABLE WATER-SAMPLE FILTRATION UNIT

The design and use of a lightweight, portable, all-plastic pressure unit for rapid field filtration of water samples is described. Water samples need to be filtered to remove particulate (suspended) material prior to analysis. Generally it is desirable to filter the sample at the time of collection to prevent the solution of suspended material and to insure that any precipitated material, at the time of analysis, was originally in solution. The unit described uses standard 4-in. diameter filter disks and may be operated at pressures up to 65 psi. The unit consists of a 2.5-liter capacity lucite cylinder with an upper plastic fitting connected to a rubber hose and a lower fitting into which a micropore filter can be inserted. A hand-operated air pump is connected to the rubber hose to apply pressure. The unit will filter 10 times faster than the suction-type field filters commonly used.

R203229 68A

Skougstad, Marvin W and Scarbro, George F, Jr

WATER SAMPLE FILTRATION UNIT

Environ Sci Technol, Vol 2, pp 298-301, Apr 1968. 4 p, 3 fig

Geological Survey, Denver, Colo

DESCRIPTORS--/ *filtration/ membranes/ *water analysis/ plastics/ data collections/ *water quality/ sampling/ chemical analysis/ laboratory tests/ portable/ water sampling/ *filters/ equipment

IDENTIFIERS-/ *micropore filters

R203250X68A EFFECTS OF TEMPERATURE ON HARDNESS IN KARST STREAMS

A study of 2 streams in limestone areas in the Pennines of Yorkshire and Derbyshire in northern England shows how biological influences dominate the pattern of seasonal fluctuations of quality in a karst area. Crowdwell rising, a spring issuing from a reef limestone, and Gordale Beck, a stream draining limestone terrain, were both sampled at monthly intervals for about a yr. Correlation coefficients show the relation between calcium carbonate content of the water and antecedent air temperature. At Crowdwell rising the best correlation is with temperatures 105-125 days earlier; at Gordale Beck, with temperatures 84-104 days earlier. Rapid increases in calcium hardness, correlated with March temperatures, are attributed to a "spring burst" of microbial activity following thawing of the soil. The quality fluctuations seem related to seasonal changes in the carbon dioxide output in the soil and the time lag approximates the flow through time of water from its entry to its exit from the limestone mass. Thus, the changes might constitute a natural tracer to measure groundwater movement. Seasonal fluctuations in groundwater quality in other rock types also might reflect the activity of organisms respiring carbon dioxide into the soil. This might apply even where the fluctuations are within a narrow range.

R203250X68A

Pitty, A F

SOME FEATURES OF CALCIUM HARDNESS FLUCTUATIONS IN TWO KARST STREAMS AND THEIR POSSIBLE VALUE IN GEOHYDROLOGICAL STUDIES

J of Hydrology, Vol 6, No 2, pp 202-208, Apr 1968. 7 p, 3 fig, 1 tab, 11 ref

University of Hull, Great Britain

DESCRIPTORS--/ *limestones/ tracers/ *air temperature/ soil chemistry/ geochemistry/ carbon dioxide/ water quality/ seepage/ *Karst/ solutes/ groundwater/ groundwater movement/ foreign research/ *hardness (water)/ calcium carbonate/ correlation analysis/ *hydrogeology

IDENTIFIERS--/ karst water/ soil bacteria/ Great Britain

R203016 66A BIBLIOGRAPHY, MARINE ENVIRONMENT--OREGON
Indexed herein are bibliographic references to literature pertaining to the marine waters of Oregon. References to papers, depending on the subject matter contained in the paper, are indexed under one or more of the following headings: Marine Biology, Climate, Fisheries, Geology, Hydrology, Chemical and Physical Oceanography, and Bibliographies, Literature Surveys, and Compilations. Has 193 references.

R203016 66A

Ditsworth, George R

ENVIRONMENTAL FACTORS IN COASTAL AND ESTUARINE WATERS, BIBLIOGRAPHY SERIES--VOLUME I, COAST OF OREGON

Federal Water Pollut Contr Admin Publ WP-20-2, Washington, D C, Oct 1966. 61 p, 193 ref

Federal Water Pollution Control Administration, Corvallis, Oreg

DESCRIPTORS--/ *estuaries/ oceanography/ bibliographies/ biology/ marine geology/ hydrology/ reviews/ climatology/ *coasts/ *coastal engineering/ environment/ *sea water/ fisheries/ estuarine fisheries/ *aquatic environment/ Oregon

IDENTIFIERS--/ *coastal waters

R203021X67A BENEFIT-COSTS FOR LOCAL WATER SUPPLY
Communities facing an industrial-municipal water shortage have 2 broad courses: either private or public financing of water-replacement projects. Whether a community could supply water at a lower cost can be decided by a benefit-cost analysis (differing from analyses for Federal projects). The annual benefit from a community project is the present value of the annual cost savings that would result from the nonundertaking of the privately financed alternatives. The average annual cost to the community is the annual net cash outlay for the purchase of water from the community project at a price just sufficient to cover the project costs. The cost of private alternatives is discounted by the corporate costs of capital; the cost of the community project, by the community's costs of capital. A direct consequence of the corporate income tax structure is that the benefit-cost ratio will always be greater than unity if the returns to scale are constant and if both the community and corporate costs are discounted at the same interest rate. A numerical example based on the corporate tax structure in Louisiana demonstrates that a community-financed project, with its lower costs of capital, almost always will be more favorable than a private one.

R203021X67A

Stober, W J and Falk, L H

A BENEFIT-COST ANALYSIS OF LOCAL WATER SUPPLY

Land Econ, Vol 53, No 3, pp 328-335, Aug 1967. 8 p, 1 fig, 1 tab, 9 ref

University of Wisconsin, Madison

DESCRIPTORS--/ capital costs/ *cost comparisons/ depreciation/ unit costs/ *benefit-cost ratios/ water supplies/ economics/ analysis/ costs/ return to scale/ *cost-benefit theory/ diseconomies of scale/ *discount rate/ tax rate/ *cost-benefit analysis

IDENTIFIERS--

R203024 67A COMPARATIVE-PROJECTION MODEL OF RESERVOIR
Using 2 established reservoir projects, an economic simulation model for reservoir development was constructed. The 2 comparative areas used for the model development are reservoirs in central Texas and were constructed during approximately the same time period. The simulation model divides reservoir development into 3 stages--construction, fill-up, and postfill-up. For each of the stages economic variables were chosen which reflected economic activity attributable to the reservoir. Inputs of construction money, O&M, recreation, and investments were related to each respective stage and then used to determine the economic impact of the reservoir on the local area economy. A synthetic index based on economic inputs other than those used for the model was developed utilizing a control area. The index served as guideline to the mathematical development of the model and as a measure of the predictive accuracy of the model. A recreational survey was conducted to arrive at average recreational expenditures and develop the postfill-up stage of the model. Overall recreational attendance was projected, and experience ratios of the survey were applied. Has 20 references.

R203024 67A

Pearson, John E

A STUDY OF THE ECONOMIC IMPACT OF WATER IMPOUNDMENT THROUGH THE DEVELOPMENT OF A COMPARATIVE-PROJECTION MODEL

Water Resources Inst Tech Rep 8, Texas A&M Univ, College Station, Aug 1967. 199 p, 20 fig, 24 photo, 53 tab, 20 ref

DESCRIPTORS--/ *economics/ recreation/ *reservoirs/ simulation/ Texas/ forecasting/ benefits/ mathematical models/ *impoundments/ evaluation/ model studies/ *economic prediction/ *economic impact/ bibliographies

IDENTIFIERS--/ *comparative-projection models/ *comparative studies

R203026 67A STORING FRESH WATER IN SALINE AQUIFERS
Preliminary studies indicate that the underground storage of fresh water in saline aquifers may be feasible from a technical viewpoint. Such a process would involve injection of fresh water, storage until needed, and subsequent production from the same well. This work, based upon theoretical considerations and model studies, leads to a computer technique by means of which the recovery of stored fresh water may be estimated. Calculations involving 5 hypothetical aquifers indicate recoveries ranging from 25 to 85%, depending upon aquifer and fluid properties. Loss of fresh water as a result of both dispersion (mixing) and gravitational segregation was considered. Results obtained in porous flow models indicate that gravitational segregation is significantly retarded by the development of a mixed zone. Such a zone is developed naturally during injection and production as a result of fluid movement and to a lesser degree during the storage portion of the cycle as a result of diffusion. Economic considerations and well problems were not treated in the study.

R203026 67A

Esmail, O J and Kimbler, O K

INVESTIGATION OF THE TECHNICAL FEASIBILITY OF STORING FRESH WATER IN SALINE AQUIFERS

Water Resources Res, Vol 3, No 3, Third Quart, pp 683-695, 1967. 13 p, 5 fig, 4 tab, 14 ref

Louisiana State University, Baton Rouge

DESCRIPTORS--/ ground water/ saline water/ water supplies/ water storage/ *underground water storage/ reservoirs/ groundwater flow/ *underground storage/ mixing/ dispersion/ density/ porous materials

IDENTIFIERS-- / saline ground water

R203033 68A THIS ENVIRONMENT--FRIEND OR FOE
This paper presents the text of the George A. Miller lecture delivered at the University of Illinois in October 1967. The author reviews the scientific, biological, and sociological changes that have altered mankind's environment during the past quarter of a century. Differing opinions are quoted for causes and control of air, soil, and water pollution and the future effect such pollutants will have on the ecology. Among the conclusions drawn are: (1) Enough water, properly managed, is available for the needs of the USA for the foreseeable future. (2) Additional water can be made available by transmission from and through Canada; by desalination when economical; and by transmission within the USA. (3) Some receiving bodies of water are of better quality today than 25 yr ago; some are worse. (4) Scientific and technologic procedures are available for upgrading quality whenever public policy so dictates. (5) Many areas of ecological behavior, not well understood, should be researched. (6) The form and fiscal basis of institutional or managerial machinery require continuing analysis and adjustment.

R203033 68A

Wolman, Abel

THIS ENVIRONMENT--FRIEND OR FOE

Water Resources Center Special Rep No 1, Univ of Illinois, Jan 1968. 15 p, 3 ref

The Johns Hopkins University, Baltimore, Maryland

DESCRIPTORS-/ *environment/ benefits/ damages/ water pollution/ population growth/ water management/ policy matters/ forecasting/ aging/ *ecology/ water resources/ public health/ water quality/ eutrophication/ air pollution/ water transfer

IDENTIFIERS-/ pollution control

R203060X68A ECOLOGY AND WATER RESOURCES DEVELOPMENT
Interactions of phenomena, conditions, and processes create certain arrangements in nature commonly called ecosystems. The public generally recognizes that water resources developments affect certain objects and conditions in nature, but does not appreciate that changes in one facet of an ecosystem have ramifications and permutations that may extend throughout the ecosystem. Unconcern for ecological side effects in water resources developments has resulted in great damage to the environment, including economic and other losses. While water developments are indispensable to the use and management of water resources, natural resources are not discrete and isolated from one another, but occur in continuously interacting complexes. Water as a resource cannot be managed safely without giving adequate consideration to the consequences of developments solely for one purpose. This fundamental point is discussed by describing several water development cases and their ecological impacts. More attention must be given to ecological research if total public interest is to be served. Losses and values foregone must be weighed against values gained if wise choices are to be made in water resources development.

R203060X68A

Cain, Stanley A

ECOLOGICAL IMPACTS ON WATER RESOURCES DEVELOPMENT

Water Resour Bull, Vol 4, No 1, pp 57-74, Mar 1968. 18 p

U S Department of the Interior, Washington, D C

DESCRIPTORS--/ *ecology/ *water resources/ environment/ biology/ lakes/ limnology/ turbidity/ aquatic life/ industrial plants/ water pollution/ fish and wildlife/ *natural resources/ estuaries/ weather modification/ fish/ pollution abatement

IDENTIFIERS--/ *ecosystems/ eutrophication/ aquatic environment/ effect/ judicial decisions/ biological communities

R203063X68A PRESERVATION AND RIVER BASIN PLANNING
Comprehensive river basin planning requires reasoned choices between potential but possibly conflicting uses of a river. One legitimate use, preservation of open spaces and wild areas, sets the stage for conflicts between development-conservationists and preservation-conservationists. Planning cannot satisfy the needs of all interested groups in the water field. Preservation values are divided into 3 elements: recreation, fish, and a set of intangible factors incorporating wilderness, natural beauty, historic, and scientific values. A single basin cannot provide the best planner with enough wilderness for every outdoorsman and enough damsites for every developer. Planners must compromise many desires and present decisionmakers with an answer that does not unnecessarily offend interest groups. Operations of the 3 Federal agencies most involved in major river basin planning (the Army Corps of Engineers, Federal Power Commission, and Department of the Interior) are discussed. Preservation by legislative action was started in 1964; subsequent legislative proposals are discussed. The Upper Missouri joint study is presented as an example of river basin planning with alternatives. Has 52 references.

R203063X68A

Tippy, Roger

PRESERVATION VALUES IN RIVER BASIN PLANNING

Natur Resour J, Vol 8, No 2, pp 259-278, Apr 1968. 20 p, 2 tab, 52 ref

Izaak Walton League of America, Glenview, Ill

DESCRIPTORS--/ *river basin development/ *planning/ water utilization/ *preservation/ river basins/ water conservation/ bibliographies/ fish/ recreation/ water management/ water resources/ rivers/ water quality/ river regulation/ multiple purpose projects/ policy matters/ project feasibility/ natural resources/ wildlife
IDENTIFIERS--/ legislation/ Corps of Engineers/ Bureau of Reclamation/ Federal Power Commission/ water resources development

R203096X68A CONCEPT OF WATER REUSE
This article explores the water reuse concept with particular attention to the meaning of the term, the several categories of reuse, and current and future status of processes involved. Water reuse refers to acceptance and use of treated waste water as a source of supply for various purposes. Reuse may be accomplished by 1 or more of 4 basic cycles: (1) hydrologic cycle--sequence of rainfall, runoff, and evaporation from surface water; (2) natural cycle--self-purification of flowing water; (3) indirect cycle--recharging ground water with treated waste water; and (4) direct cycle--planned treatment of waste water for specific subsequent use. Examples of the 4 cycles are given. Conventional treatment, desalting, and total treatment methods are discussed. Direct-cycle water reuse is possible without a health hazard, although there is some question on the necessity or desirability of direct-cycle reuse. In the near future an increase of natural-cycle reuse is expected. Indirect-cycle reuse is under intensive study and, within the next 10 yr, will be used for replenishing ground water.

R203096X68A

Symons, George E

WATER REUSE--WHAT DO WE MEAN

Water Wastes Eng, Vol 5, No 6, pp 40-43, June 1968. 4 p, 4 fig, 1 tab

Water and Wastes Engineering, New York, N Y

DESCRIPTORS--/ water pollution/ *water reuse/ water supplies/ sanitary engineering/ *water treatment/ water utilization/ waste disposal/ *waste water/ sewage treatment/ groundwater recharge/ water quality/ municipal water/ irrigation/ industrial water/ demineralization

IDENTIFIERS--/ advanced waste treatment/ waste water treatment/ *waste water use

R203154 68A WATER-SUPPLY PROBLEMS--SOUTHWEST FLORIDA
A 300% population increase in 15 yr has created regional water problems, such as sea-water intrusion and shortages of supply, all related to attempts to modify and control the environment without adequate knowledge of the effects. Some conditions require immediate corrective action. Others, such as general lowering of water levels and gradual increase in chloride, ultimately will pose serious problems and limit further use of water. Sea-water intrusions are now avoided by building well fields in inland areas. A program to plug deep wells is relieving salt-water contamination of streams and shallow aquifers. Establishing a salinity line can forestall problems related to sea-water intrusion in canals and provide control of fresh-water discharge. Effective management and control of all water are required to forestall further deterioration and depletion of supply. Illustrations show rainfall-runoff comparisons, effects of pumping and rainfall on water levels, extent of salt-water intrusion in a shallow aquifer, and hydrologic conditions in uncontrolled and controlled canals carrying sea-water, Broad-area hydrologic studies under the total water concept are needed to provide data for problem solving and to guide in orderly development and management of the region's water resources.

R203154 68A

Boggess, Durward H

WATER-SUPPLY PROBLEMS IN SOUTHWEST FLORIDA

Geol Surv Open-File Rep, 1968. 27 p, 6 fig, 3 tab, 7 ref

Geological Survey, Washington, D C

DESCRIPTORS--/ *surface-groundwater relationships/ *water management (applied)/ hydrogeology/ canals/ Florida/ drainage/ artificial recharge/ aquifers/ water table/ artisian wells/ *water quality/ urbanization/ tidal waters/ saline water intrusion/ droughts/ rainfall/ runoff/ water level fluctuations/ water utilization/ *water supply/ irrigation
IDENTIFIERS--/ stream contamination/ *water appraisal needs/ land-use practices/ sea-water intrusion/ *quality deterioration

R203212 68A INCOME REDISTRIBUTION FROM RESERVOIR CONSTRUCTION
Because water resources investment has been evaluated from the economic efficiency objective, benefit-cost analysis has been criticized as ignoring other goals. Benefit and cost data collected for Dewey Reservoir in the Appalachian Mountains of eastern Kentucy were used to determine the incidence of benefits and cost among income intervals. Recreation as a project purpose proved more effective in redistributing income than flood control. Weighting the income maximization and income redistribution objectives according to the value judgment that income taxes collected represent equimarginal sacrifice showed income redistribution benefits to equal 18.2% of efficiency benefits. The percentage would be lower in higher income areas.

R203212 68A

James, L Douglas

A CASE STUDY IN INCOME REDISTRIBUTION FROM RESERVOIR CONSTRUCTION

Water Resour Res, Vol 4, No 3, pp 499-506, June 1968. 8 p, 3 tab, 13 ref

University of Kentucky, Lexington

DESCRIPTORS--/ flood control/ recreation/ optimum use/ *benefits/ cost-benefit ratio/ water utilization/ efficiencies/ *feasibility studies/ *reservoirs/ economics/ economic efficiency/ cost-benefit analysis/ *public benefits/ recreation facilities

IDENTIFIERS--/ *income redistribution

R203265 67A WATER RESOURCE DEVELOPMENT IN THE FARMINGTON VALLEY
The purpose of this study is to examine critically the pattern of governmental organization and the process of planning in one river basin--the Farmington Valley, which contains the largest of the tributaries to the lower Connecticut River. Specifically, the present study seeks to analyze the validity of the hypotheses suggested in prior studies as to the problems of governmental organization, the role of water resource interest groups (as represented by the Farmington River Watershed Association), and local attitudes toward the public interest. The analysis presents preliminary findings concerning the characteristics and roles of 2 principal parties in water resource management and planning in the Farmington Valley: key governmental agencies and the Farmington River Watershed Association. Further computer analysis will unearth more detailed relationships among the variables suggested. Subsequent findings will also concentrate on the comparable results for the 383 interviews taken among the general public. From this data analysis, it will be possible to relate the planning and managerial process in the Farmington Valley to the more general theoretical discussion of major political, organizational, and behavioral issues--to how men think about and how political systems utilize their natural resources.

R203265 67A

Kasperson, Roger E

POLITICAL ORGANIZATION AND THE PLANNING OF WATER RESOURCE DEVELOPMENT IN THE FARMINGTON VALLEY--A PRELIMINARY PROFILE

Inst Water Resour Rep 5, Univ Conn, Oct 1967. 20 p, 13 tab, 1 map, append

University of Connecticut, Storrs

DESCRIPTORS--/ *water resources/ water development/ *river basins/ *planning/ organizations/ drainage basins/ interstate compacts/ water policy/ public utilities/ questionnaires/ valleys/ watersheds/ river basin commissions/ administrative agencies/ political aspects/ *water resources development/ interstate/ federal government/ Connecticut
IDENTIFIERS--/ *Farmington River, Conn/ *regional planning

R203268 66A FINANCING STATE WATER PROJECTS
The interjurisdictional aspects of financing water resource development projects that result from the possibility of spillovers are explored and certain conclusions regarding the proper roles of the federal, state, and local governments are developed. A discussion of the relevant economic theory is presented, efficiency criteria are developed and are applied to water resource projects. An analysis of the relative merits of user charges and taxes offered and conclusions regarding the inadequacy of benefit-cost data for particular benefit types are shown to prevent the establishment of a theoretically justifiable revenue system. Some state policies are analized in the light of the analysis developed in the report.

R203268 66A

Daicoff, Darwin W

METHODS OF FINANCING STATE PARTICIPATION IN WATER RESOURCES DEVELOPMENT

Contrib No 4, Univ Kans, 1966. 34 p

University of Kansas, Lawrence and Kansas State University, Manhattan

DESCRIPTORS--/ *states (geographical)/ *water resources/ benefits/ flood control/ *projects/ water development/ economics/ benefit-cost ratios/ *finance/ taxes/ *methodology/ costs/ water laws/ Federal government/ local governments/ cost allocation/ legal aspects/ Kansas

IDENTIFIERS--/ revenues

R203271 67A OPTIMIZATION OF A WATER RESOURCES SYSTEMS
This report presents a portion of the results of a 2-yr project intended to develop analytical methods for optimization of water resources systems. Methods described were derived in rigorous context with the physical, legal, social, and economic realities of combined major water resource projects. Four major streams, 10 reservoirs, and associated pumping plants, aqueducts, and power generation facilities are included in the analysis. The objective maximized in this instance is financial feasibility for planning purposes based on deliveries of firm energy, firm water, off-peak energy, and off-season water. Output should be attainable by feasible operations during an historical sequence of dry years and was imposed as a planning criterion on the system. Analysis provides for specification of values, within complexly constrained limits, of firm energy, firm water, dump energy, and dump water to be produced in each of 120 periods in the critical periods at each of 10 reservoirs comprising 5 major subsystems. The procedure will be useful for determining the integrated system optimum outputs for firm water and energy. The analysis emphasized advantages of system operation, as compared to individual project operation under firm water and power contracts.

R203271 67A

Hall, W A and Shephard, R W

OPTIMUM OPERATIONS FOR PLANNING OF A COMPLEX WATER RESOURCES SYSTEM

Water Resour Center Contrib 122, Dec 1967. 75 p, 8 fig, 5 tab, 14 ref, 6 photo, 12 chart

University of Los Angeles, Calif

DESCRIPTORS--/ water resources/ *optimum use/ multiple purpose projects/ mathematical analysis/ water supply systems/ mathematical models/ linear programming/ hydroelectric power/ peak power/ power system operations/ decision making/ water delivery/ reservoir operaton/ *water utilization/ *water management applied/ *optimization/ marketing/ economics/
IDENTIFIERS--/ California State Water Proj

R203282 68A INPUT-OUTPUT MODEL FOR ECONOMIC EVALUATION OF WATER
This study reports the fifth phase of a continuing project concerned with the Economic Evaluation of Water conducted by the Sanitary Engineering Research Laboratory of the University of California under the sponsorshop of the University's statewide Water Resources Center. Today it is becoming widely recognized that water resource decisions must involve mass transfers of water for multiple benefits within regions encompassing areas which have potential for economic growth competing with others already highly developed economically. The objective of this study is to provide a technical basis for evaluation of effects of water resources policy in the Western States not only upon the economic sectors of the state itself but also upon its neighbors. This is the first stage of Phase 5 of the series and is designed to incorporate results of input-output research which has recently been undertaken in various Western States into construction of a multiregional input-output model. It follows the current interest of economic analysts in constructing models which tie together those of separate regions. Has 148 references.

R203282 68A

Davis, H Craig

ECONOMIC EVALUATION OF WATER--PART V--MULTIREGIONAL INPUT-OUTPUT TECHNIQUES AND WESTERN WATER RESOURCES DEVELOPMENT

Contrib 125, Univ California, Feb 1968. 142 p, 17 tab, 148 ref, 3 append

University of California, Berkeley

DESCRIPTORS--/ *water/ *water costs/ economics/ water resources/ states (geographical)/ bibliographies/ benefits/ *water development/ computer programming/ *policy matters/ mathematical models/ cost allocation/ input-output analysis

IDENTIFIERS--/ *input-output conversion

R203272 68A LAKE-ORIENTED RESIDENTIAL SUBDIVISIONS
The subject of this study is lake-oriented residential subdivisions located within the state of North Carolina. Specifically, focus is on the consumer of this type of development--the home buyer. This study looks at decisional variables of the home buyer to determine inputs for a consumer submodel linked to residential growth model. The home buyer's decisions are constrained largely by supply of dwelling sites provided. The consumer influences future development of residential sites by making choices among existing alternatives. One popular alternative in North Carolina recently is the lake-oriented residential subdivision. This study is primarily concerned with improvements in living environment of the housing consumer through the process of moving to new locations. Specific objectives of the study are to: (1) identify decisional variables for the buyer in a lake-oriented subdivision; (2) investigate methods for forecasting this type of demand, and (3) identify the consumer's attitudes regarding advantages and disadvantages of living in a lake-oriented subdivision. Interviews were conducted to more fully understand the preferences of consumers and their effect on decisions about moving. Has 32 references.

R203272 68A

Andrus, Newton W

LAKE-ORIENTED SUBDIVISIONS IN NORTH CAROLINA: DECISION FACTORS AND POLICY IMPLICATIONS FOR URBAN GROWTH PATTERNS--PART II - CONSUMER DECISIONS
Water Resour Res Inst Rep 10, Univ North Carolina, Apr 1968. 88 p, 4 fig, 26 tab, 32 ref, 3 append

University of North Carolina, Chapel Hill

DESCRIPTORS-- / real property/ *housing/ recreation/ urban areas/ land development/ *recreational facilities/ municipalities/ *lakes/ cities/ reservoirs/ marketing/ consumers/ *city planning/ water resources/ land use/ urbanization/ *community development/ *urban sociology/ water resources development/ lake shores/ North Carolina
IDENTIFIERS--

NUMERICAL INDEX

Volume 1, Number 9

Document No.	Page No.
R203009 67A	96
010 67A	96
011 66A	84
012 67A	97
013X67A	52
014 67A	52
015X67A	17
016 66A	106
017 66A	97
018 68A	98
R203019 67A	98
020 67A	84
021X67A	106
022 67A	99
023 67A	18
024 67A	107
025 67A	18
026 67A	107
027 67A	53
028 67A	99
R203029 67A	85
030 67A	100
031 67A	53
032 68A	1
033 68A	108
034 68A	54
035X68A	40
036X68A	92
037X68A	45
038X68A	45
R203039X68A	46
040 68A	41
041X68A	100
042 68A	46
043 68A	19
044X68A	1
045 68A	82
046X68A	47
047X68A	35
048X68A	73
R203049X68A	74
050X68A	47
051X68A	10
052X68A	12
053X68A	13
054X68A	36
055X68A	36
056X68A	72
057 68A	5
058 68A	75
R203059 68A	13
060X68A	108
061 68A	54
062X68A	37
063X68A	109
064 68A	48
065 68A	2
066X68A	2
067 68A	3
068X68A	74
R203069X68A	101
070 68A	55
071X68A	5
072X68A	19
073X68A	92
074X68A	70
075X68A	101
076X68A	102
077 68A	48
078 68A	41
R203079X68A	14
080 67A	83
081 68A	10
082 68A	11
083 68A	102
084 68A	14
085X68A	3
086X68A	4
087X68A	37
088X68A	4

NUMERICAL INDEX - Continued

Document No.	Page No.
R203089X68A	55
090X68A	56
091X68A	103
092X68A	103
093X68A	73
094X68A	93
095X68A	71
096X68A	109
097 68A	11
098X68A	49
R203099X68A	75
100 68A	15
101 68A	49
102 67A	15
103 67A	16
104 68A	38
105 68A	38
106 68A	39
107 68A	39
108 68A	40
R203109 68A	104
110 67A	104
111 68A	85
112 68A	86
113 67A	20
114 67A	71
115 68A	6
116X67A	20
117 67A	56
118X67A	93
R203119X67A	9
120 68A	94
121X67A	76
122X68A	21
123X67A	42
124 67A	76
125 67A	21
126X67A	22
127 68A	22
128X67A	94
R203129 67A	23
130 68A	95
131X67A	57
132 67A	23
133 68A	77
134 67A	57
135X67A	95
136X67A	24
137 67A	24
138X67A	25
R203139X67A	6
140 68A	58
141X67A	72
142 68A	42
143 68A	88
144X67A	89
145X67A	89
146X68A	25
147 67A	43
148 67A	43
R203149 68A	86
150 68A	16
151X68A	83
152 68A	26
153 68A	58
154 68A	110
155 68A	59
156 68A	59
157 68A	60
158 68A	17
R203209X67A	60
210 68A	77
211 68A	61
212 68A	110
213 68A	61
214 68A	62
215 68A	81
216 68A	62
217 68A	26
218 68A	27

NUMERICAL INDEX - Continued

Volume 1, Number 9 - Continued

Document No.	Page No.
R203219 68A	90
220X67A	87
221 67A	81
222 68A	82
223 68A	63
224 67A	78
225 68A	87
226 68A	63
227 68A	9
228 68A	27
R203229 68A	105
230X68A	88
231X68A	7
232 68A	64
233 68A	44
234X68A	28
235 68A	7
236 68A	28
237X68A	64
238X68A	50
R203239 68A	78
240X68A	8
241X68A	65
242X68A	65
243X68A	29
244 68A	29
245X68A	50
246 68A	30
247X68A	66
248 68A	79
R203249 67A	79
250X68A	105
251X68A	30
252X68A	80
253X68A	31
254 68A	66
255 68A	90
256 67A	91
257 68A	31
258 67A	91
R203259 67A	12
260 67A	51
261 68A	32
262 67A	67
263 67A	32
264 66A	67
265 67A	111
266 68A	68
267 67A	33
268 66A	111
R203269 67A	68
270 67A	44
271 67A	112
272 68A	113
273 68A	69
274 68A	33
275 68A	51
276 67A	34
277 68A	80
278X68A	8
R203279 68A	34
280 68A	69
281 68A	35
282 68A	112
283 68A	70

GPO 846 - 300